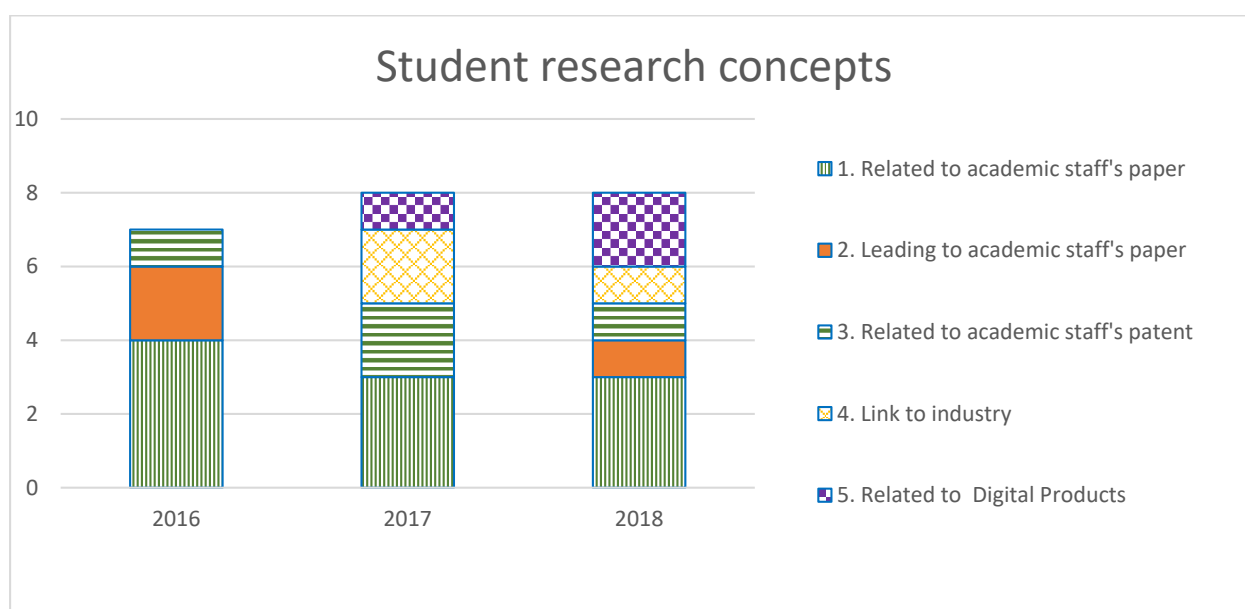


Exhibit 11.4-1 Student research concepts

1. Report of student research concepts

	2015	2016	2017	2018
1. Related to academic staff's paper	7	4	3	3
2. Leading to academic staff's paper	2	2		1
3. Related to academic staff's patent	2	1	2	1
4. Link to industry			2	1
5. Related to Digital Products			1	2



Research Projects Abstract

Of

Materials Science (Gems and Jewelry) Program

Faculty of Science, Srinakharinwirot University

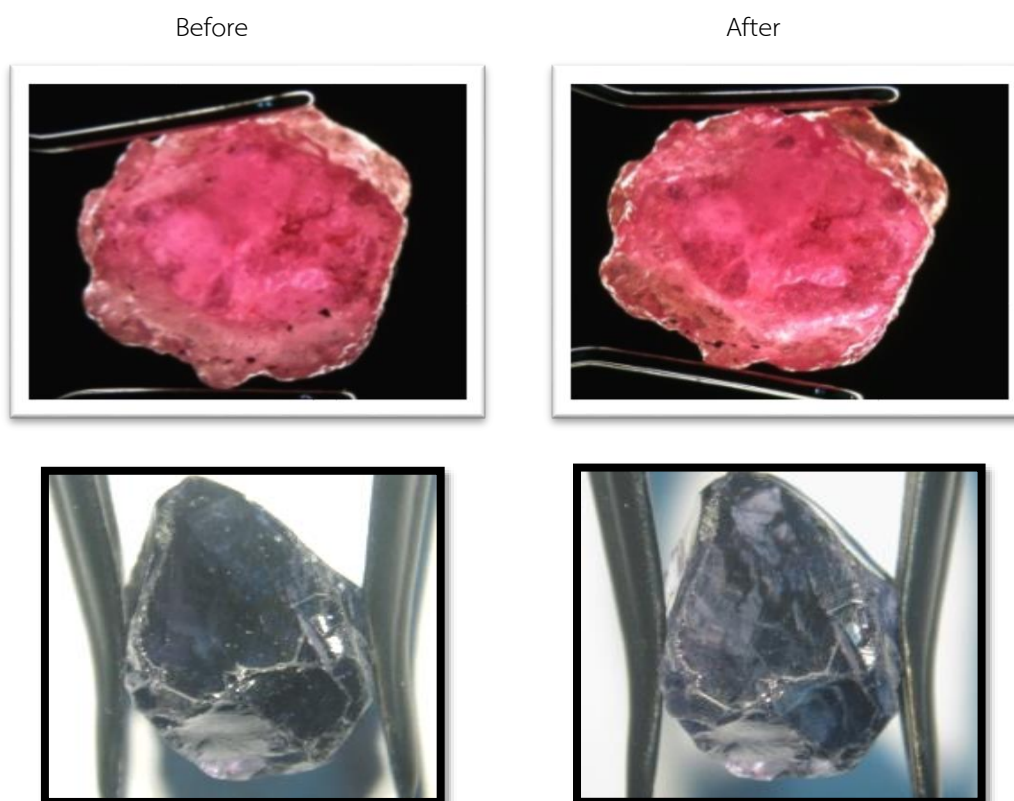
2555/2012



The Study Of Possibility For Modification Natural Corundum Gemstone By Ion Implantation Technique

Chittiya Sirilaptham, Philaiporn Singthong , Somruthai Suksawat,
Dr.Amonmat Kiratisin and Dr.Duangkhae Bootkul

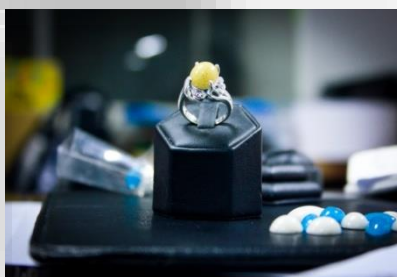
Gem quality natural corundums are extremely rare and expensive, thus various enhancement methods have been applied on them, such as heat treatment and lattice diffusion, etc. However these methods still have many restrictions. Therefore, the ion implantation technique has been applied on our corundum samples as a new gem enhancement method. By implanting ions into gem materials, it can improve the quality of gems, thus this technique is a non-destructive technique. In this study, 2 types of ions are used : Argon ion (Ar^+) and Nitrogen (N^+). Argon ion (Ar^+) at dose 70 keV for 90 minutes could improve the color of ruby samples but did not affect the blue sapphire samples. It could also reduce lead (Pb) in lead glass filled ruby samples. In part of implantation of Nitrogen ion (N^+) at dose 70 keV for 60 minutes and 90 minutes could improve both clarity and color of blue sapphire samples. However, color of ruby could not be modified by this technique. Nevertheless, Clarity of every corundum samples could be improved ion implantation technique.



A Feasibility Study for New Type of Turquoise Jewelry from Glass-Ceramic Composite

Pailin Chaweewanpakdee, Tanachaorn Tammapirom and Piyanuch Sawasdee
and Dr. Duangkhae Bootkul

Glass-ceramics are composite materials produced through controlled crystallization of base glass called "controlled crystallization". Glass-ceramics have an amorphous phase and one or more crystalline phases mean that materials share many properties with both glasses and ceramics. The purpose of this research was to produce glass-ceramic from recycled glass and kaolin clay addition. The recycled glass of soda lime silica glass (SLSG) was used as main raw materials and kaolin clays as reinforce filler. The glass powders are prepared by crushing to a particles size distribution 100-200 μm . The SLSG powder were then mixed with the kaolin clay according to the ratio of SLSG to kaolin clay of 75:25 wt.%, 80:20 wt.% 85:15 wt.% 90:10 wt.% and 95:5 wt.%. The glass ceramic samples were fabricated using uniaxial pressing and cold isostatic pressing with constant pressure at 1500 PSI. Heating process was conducted at different temperatures at 850°C and 1,000°C with 4 hrs holding time. There are several changes in terms of shape, color and appearance in the temperature rang and after supercooled state. Temperature 1,000°C with 90:10 wt.% ratio of SLSG to kaolin clay is the best result in term of color and physical properties. Additional of 0.5-2% copper metal was incorporated for more appearance to produce new glass-ceramic material for Turquoise costume jewelry prototype.



The Study Of Characteristics In Alloy To Replace Sterling Silver In Jewelry Industry

Prasarn Jiambutr, Tipsuda Sathukijchai, Paranyu Sukthanakij
and Asst.Prof.Dr. Kageeporn Wongpreedee

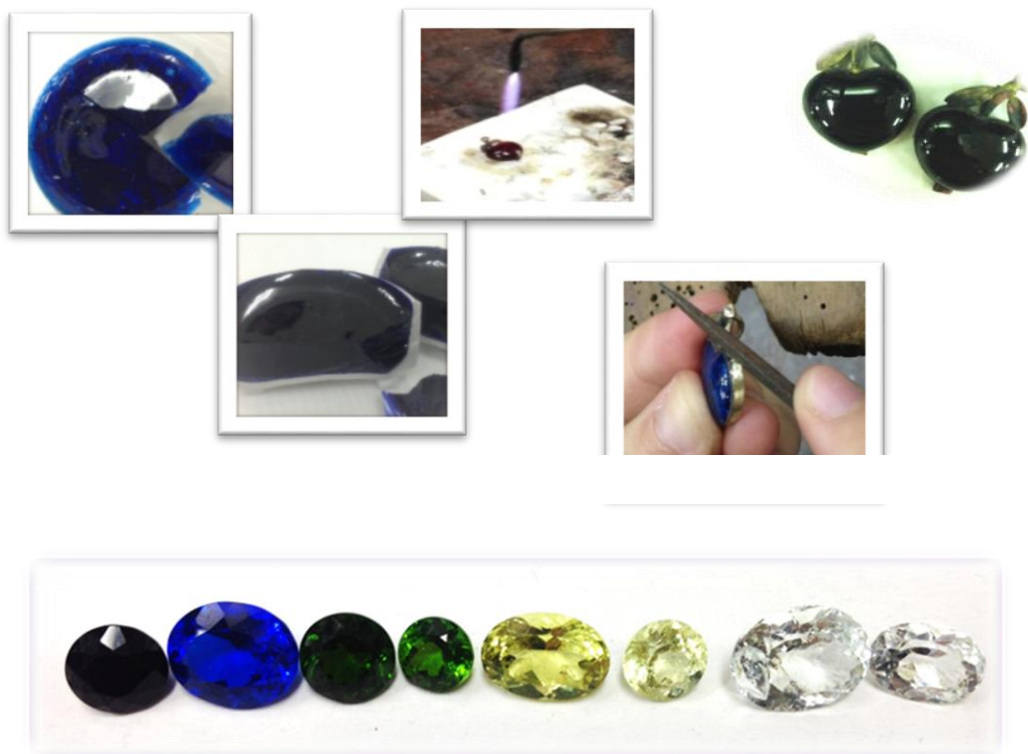
Nowadays, manufacturers in Jewelry industry are demanding the uses in white alloy as a substitute substance of sterling silver. Many replacing alloys had been introduced. However, it contains nickel element which is harmful to the users. The objective of this research was to study about physical and mechanical properties of white alloy of Cu-Sn systems, dividing experiments into four parts; 1) Study physical properties such as color and luster. 2) Study the cooling and annealing processes which had an effect to the relationships of microstructures and characteristics in the alloys. 3) Study the cooling rate of alloys from results of various casting and flask temperatures at different sizes of design shapes and 4) Study the probability in casting jewelry prototype. The research found that 60 – 70wt%Sn produced silver-liked color consisting of ϵ -phase, η -phase, Sn-phase with hardness of 410.3HV, 404.4HV, 20.1HV, respectively. The reduction in 70wt%Sn had a higher percentage of reductions comparing to 60wt%Sn due to the higher amount of Sn-phase dispersed in alloys. It is more likely that 70wt%Sn might be suitable for producing jewelry prototypes.



Vitreous Lead Free Enamel For Jewelry From Raw Waste Materials

Kanokrat Noiaram, Lawan Sucheewakul and Narumol Sae-Ong
and Asst. Prof. Natthapong Phinichaka

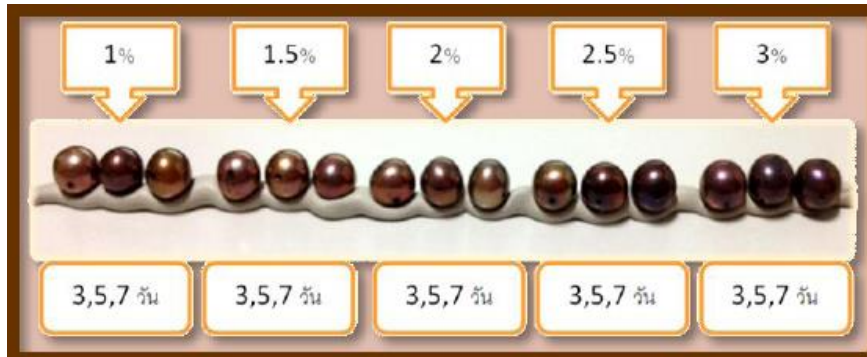
Vitreous lead free Enamel for jewelry is successfully prepared by using raw waste materials. The aim of this work is to develop lead free enamel by using eggshell waste and cullet. Raw duck eggshells were calcined in an air atmosphere for 3 hours at different calcination temperatures 900, 1000 and 1100°C. X-ray diffractometer (XRD) and X-ray fluorescence spectroscopy (XRF) were used to characterize the obtained calcined samples. Vitreous lead free enamel frit is produced by fusing sodium-borate compound, K_2CO_3 , cullet and 13-21% of calcined eggshell powder in the furnace. These obtained frits are glossy and luster and have melting point between 800-900°C. When they are applied to jewelry they show good adhesion on the metal surface. The hardness of the enamel is 480 HV or around 7 Moh's Scale, measured by using Micro Vicker hardness tester and their refractive index are found to be between 1.57-1.58.



Color-Enhanced Freshwater Cultured Pearl (China) Using Silver Nitrate To Chocolate Pearl

Pitchaya Jearmaneengam, Suthathip Viriyapumisiri and Supaporn Srichan,
Dr. Bongkot Phichaikamjornwut and Dr. Amonmat Kiratisin

Color-enhanced freshwater cultured pearl (China) in this study was done by using various concentrations of silver nitrate solution as dying agent to chocolate pearls. The samples were soaked in 1, 1.5, 2, 2.5 and 3 wt.% solutions, each for 3, 5 and 7 days, respectively. The experimental results showed that the 1.5 and 2 wt.% of silver nitrate, for 3 and 5 days represented beautiful brown color and nice pearly luster. UV-Vis-NIR spectra showed the reflectance band at 560-750 nm and CIE Lab color in a and b positive axis showed red and yellow color. The color-enhanced freshwater cultured pearl using dying method to chocolate pearl could be applied on Thai freshwater cultured pearl which would add the value to them and make them marketable in gems and jewelry industry.



A Created Design On The Surface Of Lop Buri Chalcedony Gemstone

Benjaporn Maneebang, Eakkanai Tumkeaw, Ratchadaporn Dechpong
and Assoc. Prof. Dr. Seriwat Saminpanya

Chalcedony is a variety of quartz mineral with tiny fibrous aggregate habit that can be commonly found in Thailand. The white translucent mineral samples from Lop Buri, Thailand has been value-added by cutting and polishing in cabochon style and staining/etching on their surface to yield the attractive design to jewellery market. We used the gemmological standard equipments and Raman microprobe to confirm the identity of the mineral (e.g. refractive index, $RI = 1.541-1.545$ and Raman peak = 464.7 cm^{-1}). The samples were bleached by nitric acid (95%) for 7 days before applying the design. There are 2 methods to achieve the goal:

1) **Staining:** using the cut sticker of pattern sticking on the sample surface then directly staining on the exposure area of the sample surface by soaking in silver nitrate 1.5% for 7 days after that heating the samples under 300°C for 1 hour in the oven.

2) **Staining and etching:** after staining the naked sample with silver nitrate 1.5% for 7 days plus heating the samples under 200°C for 1 hour in the oven after that using the cut sticker of pattern sticking on the sample surface then etching the exposure area of the sample surface by hydrofluoric acid for 30 minutes.

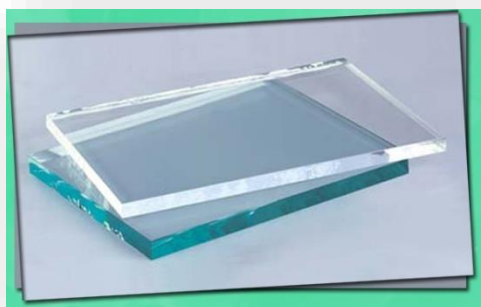
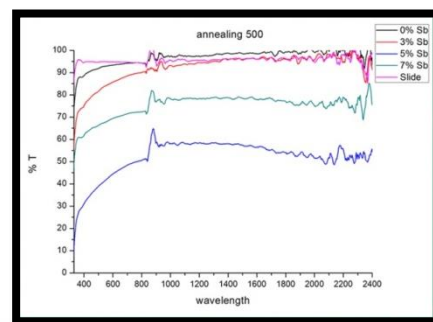
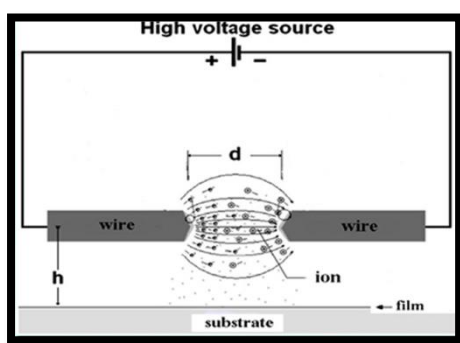
The fading tests by using the everyday-life chemicals e.g. detergent and washing liquid did not affect the treated samples.



Preparation of Antimony Tin Oxide (ATO) Thin Film by Sparking Process

Kulaya Chaisittichai, Kasem Jiramongkolrat, Sudarat Krachotchai
and Dr.Thanut Jintakosol

This research has been preparation of Antimony doped tin oxide (ATO) thin films on glass substrates by Sparking process. The sparking off two metallic alloys tip by direct current in air at atmospheric pressure. Therefore, the air molecules were ionized and accelerated to collide with the metallic alloy tips and deposited on a glass substrate. The films were annealed at temperatures of 300, 400 and 500 °C for 1 hour and examined thin films nanostructure by Atomic Force Microscope, the surface structure by Scanning Electron Microscope, optical properties by UV/VIS Spectrophotometer and structural features were characterized by Raman Spectroscopy. From the results, it is showed nanoparticles structure of ATO thin films on glass substrate. The roughness was increased and transmittance decrease with an increase concentration of antimony. After annealing at temperature of 300, 400 and 500 °C for 1 hour. Annealing probably to improved crystallinity of the films and reduces the surface roughness. Increasing the annealing temperatures, the optical transmittance was increased and the roughness was decreased.



Feasibility Studies Of The Fragrance Jewelry Development

Pakawan Sangoontrakarkul, Watcharakorn Panmanee, Witchulada Rangkakoonnuwat
and Dr. Amonmat Kiratisin

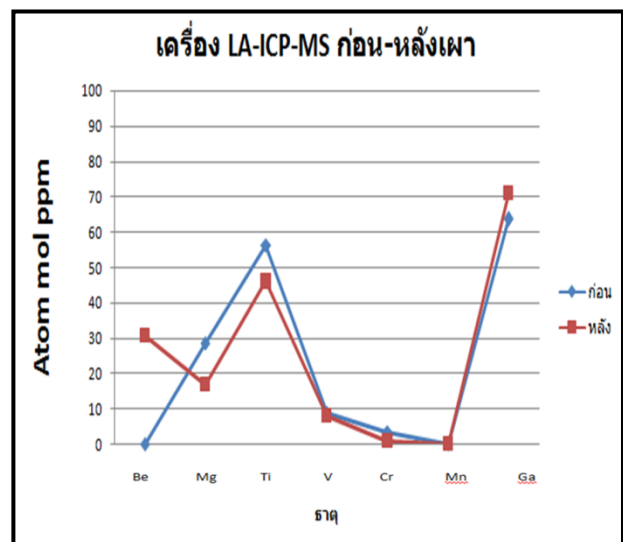
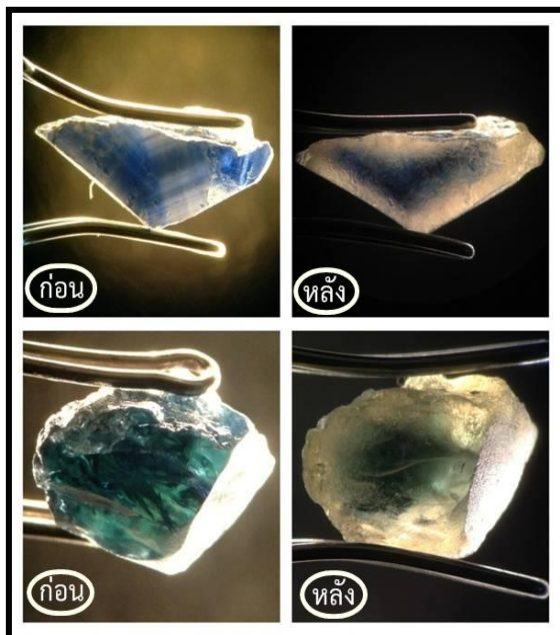
The studies of fragrance jewelry production were aimed to create an alternative jewelry for Thai jewelry market which should be attractive and practical. Soil composed of SiO_2 and Al_2O_3 was used in this studies because its moldable and coloration properties, which were suitable to used as fragrance material in jewelry. Liquid soil was settle in a spherical mold, then annealed at 800°C . Specific gravity, liquid absorption and pore density have been studies on this material. The soil was scented and tested the specific gravity, liquid absorption and pore density using BET surface area tool until the material turned into suitable fragrance jewelry. Fragrance was poured into the material which has been set as sample jewelries. Then, consumer attitude test has been done on 20-25 years old women. The research showed positive sign to the fragrance jewelry. It appeared that the target group paid a lot of interests because of the novelty of the jewelry that the consumers found the perfectly integration of the fragrance and jewelry.



The Study Of Blue Sapphire From Shang Dong Heat Treatment With Added Beryllium

Saksit Pholmana, Arunee Hirunyatrakarn, Thunpong Dilokpanyalert
and Seriwat Saminpanya

The purpose of this research was to study certain trace elements before and after Be heat treatment on the dark blue sapphires (6-6.5 mm.) from Shangdong, China. A temperature used was 1,755 C ° with soaking time of 140 hours. The treated samples show yellow at the rim (~ 2.08 mm. thick) with the dark blue core. The spot analyses by Laser Ablation Inductively Couple Plasma Mass Spectrometer (LA-ICP-MS) show that the Be content is higher at the rim and lower at the core of samples (26.53-36.11 ppm). Laser Induced Breakdown Spectrometer (LIBS) confirming that the Be content is higher in the treated sample than in untreated samples. The $\text{Fe}^{2+}/\text{Ti}^{4+}$ peak intensity from UV-VIS-NIR Spectrophotometer of the treated samples is lower than those of untreated samples.



Comparision Study on Attitude of Gems Faceter Toward Traditional Faceting Tools and Precision Faceting Machine in Thai Lapidary Industry

Sarocho Satawiriya, Sujitra Wanichanan, Wachiraya, Ruampatana
and Dr. Amonmat Kiratisin

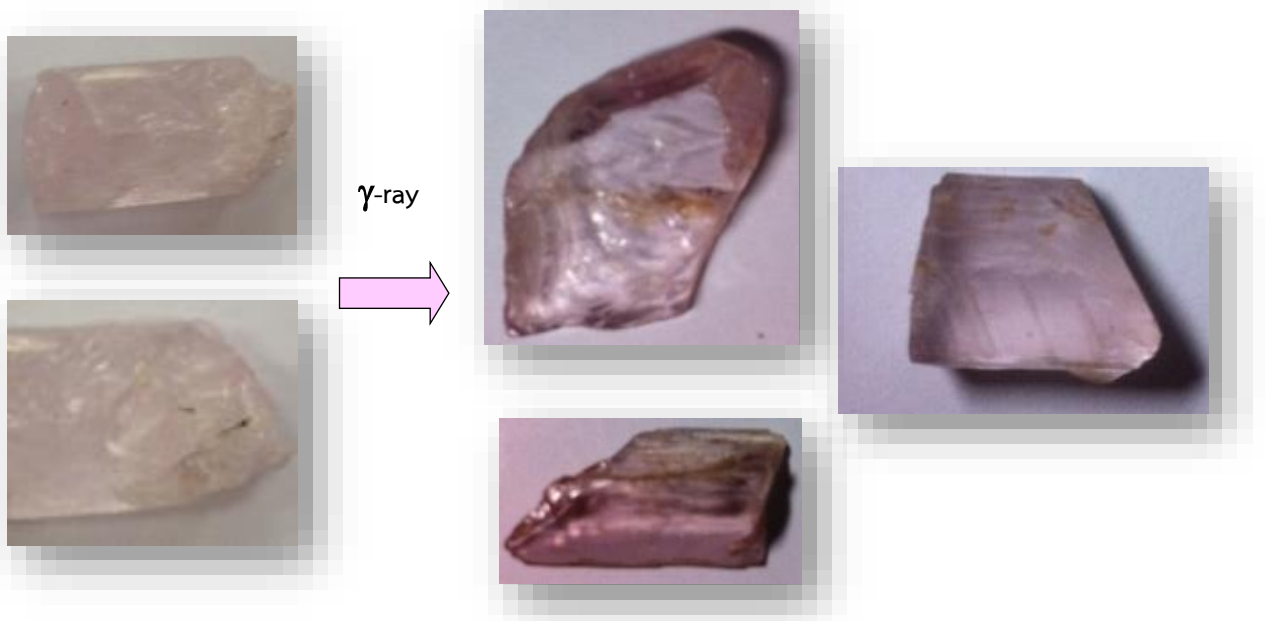
The project aims to study on the attitude of gems faceting apprentice and professional gems faceter toward Precision Faceting machine. The method of surveying, firstly, is inquiring and interviewing some gems faceting entrepreneurs and high experience gems faceters by using a specific set of questionnaire. The purpose of this is to form another 2 series of experimental questionnaire. Then, a target group is set. This target group is compose of a teacher from Bangkok Metropolitan Vocational School and 5 new students, gems faceting apprentices, whereas the teacher is regarded as a professional gees faceter. Before testing the machine the target group has to answer the Questionnaires 1 (Q1). The content of the Q1 is related to data collecting on a) the efficiency of the gems faceter, b) the effectiveness of faceting, and c) the attitude of gems faceters toward using the Precision Faceting machine. Machines are used and data are recorded during the experiment. When it is over, the target group has to answer the Questionnaires 2 (Q2) which related to points of view of the target group to “choose” or “non-choose” to use the machine. After analysis the result from Q1, Q2 and data record sheet we found that the Precision Faceting machine can decrease the period of learning before becoming a gems faceter but cannot decrease the period of facet the gems stone per piece and total lost percentage of gems stone weight. So this machine is specifically appropriate to use in semi-precious gemstone lapidary industry.



Color-Enhanced Kunzite Using Gamma Irradiation And Heat-Treatment

Jutharat Saman, Natthaya Sorntang, Piyaporn Pholcheewin,
Dr. Bongkot Phichaikamjornwut and Dr. Amonmat Kiratisin

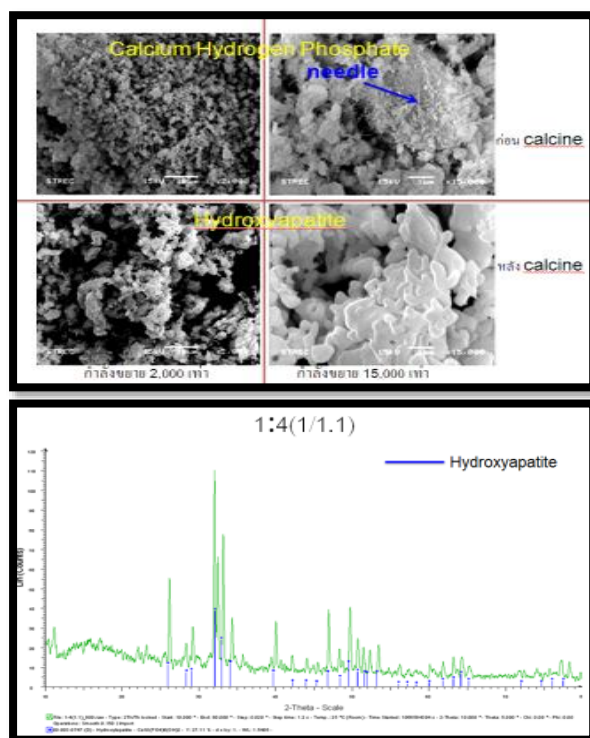
Color-treated using irradiation could be done in semi-precious stones. Kunzite was irradiated by gamma irradiation (^{60}Co), which requires less irradiation time, then heat-treated to changed colorless spodumene and/or very slightly pink kunzite to lilac or purplish pink color. The experiments used gamma radiation in several doses to changed colorless spodumene into green, known as hiddenites. Irradiated sample was then heated at 230°C which the color turned into purplish pink. The gamma irradiation dosage did not affect color after annealing. The UV-Vis-NIR spectra showed absorption band of Mn^{3+} at 350-380 nm. Kunzite from Brazil showed more pink color than kunzite from Africa.



The Study of Possibility to Synthesize Hydroxyapatite and β -Tricalcium Phosphate From Waste Eggshell In Laboratory Scale

Nuttachai Korphaophanich, Thanapun Lhuaamporn, Sopitruk Kontongern
and Asst. Prof. Natthapong Phinichka

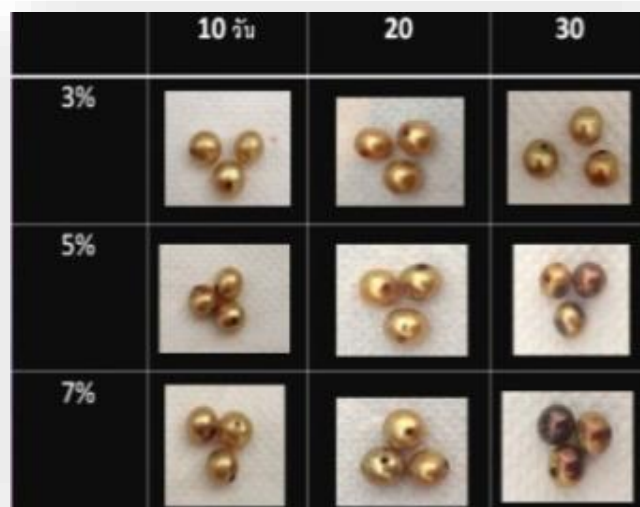
This experiment is aimed to synthesize Hydroxyapatite ($\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$) from calcium oxide obtained from calcined eggshell. Raw eggshell was calcined in an air atmosphere for 3 hours at different calcination temperatures 900, 1000 and 1100°C. X-ray diffractometer (XRD) and X-ray fluorescence spectroscopy (XRF) were used to characterize the obtained calcined samples. The grinded eggshell calcined at 900°C was selected to mix with phosphoric acid at different ratios. Ethyl alcohol was added to the mixture at mixing ratios changed from 1:1 to 1:6. The mixtures were then ball-milled with porcelain media for 24 hours. XRD was used to observed phases of the milled powders. It was found that at ratio between calcined eggshell in phosphoric acid and ethyl alcohol equals 1:4 gave the best result. All of the milled powders were heated at 900°C for 2 hours then examined their phases and morphology by suing XRD and SEM respectively. The results show that at certain ratio and process parameter pure Hydroxyapatite can be prepared.



Dying Saltwater Culture Pearl “*Pinctada fucata*” to Golden Pearl

Khemika Lompitak, Paveena trakultungjit, Punnapar ruksongmaun,
Dr. Bongkot Phichaikamjornwut and Dr. Amonmat Kiratisin

“*Pinctada fucata*” saltwater cultured pearl from Phuket Island was color-enhanced by using potassium permanganate solution to golden the pearls. They were immersed in 3, 5 and 7%wt. potassium permanganate solution, for 10, 20 and 30 days for each concentration. The results showed that dying the pearls in 5%wt. of potassium permanganate solution for 20 days produced beautiful golden color and nice pearly luster. UV-Vis-NIR spectra showed the absorption band at 380-500 nm. Chemical analysis using EDXRF showed higher MnO content after dying process. Thus, the color-enhanced saltwater cultured pearl using potassium permanganate to golden pearl could add the value to Thai saltwater cultured pearl, which would make them marketable in gems and jewelry industry.



The Adsorption Of Silver Ion From Silver Nitrate By Chitosan And Chitosan-Carbon Nanotube Composite

Arthistiyar Hinveera, Bhuwadol Fakgaeo, Orakarn Trairattananusorn,
Dr.Thanut Jintakosol and Dr.Walaikorn Nitayaphat

This research was silver ion adsorption equilibrium experiments in silver nitrate solution which were carried out as a function of contact time, chitosan-carbon nanotube concentration, pH value and adsorbent dosage level. The equilibrium time of silver ion adsorption was found to be 180 min. Composite adsorbent had the highest adsorption efficiency when the weight ratio was 10/1. The maximum silver ion removal took place at the initial pH value of 3.0. The optimum adsorbent dosage for silver ion removal was 3.0 g. Under above optimal condition the maximum silver ion removal was 99.25%. The adsorption isotherm of chitosan-carbon nanotube composite beads agreed well with the Langmuir model.



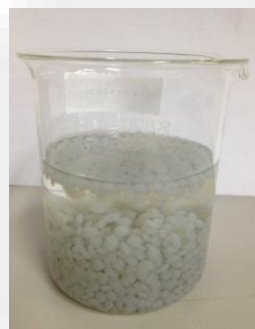
Chitosan



Carbon Nanotube



Chitosan beads



Chitosan-Carbon Nanotube composite beads



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MATERIALS SCIENCE
(GEMS&JEWELRY) PROGRAMS
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RESEARCH PROJECT ABSTRACT

FEB, 2014
PRESENT AT
BANGKOK GEMS &
JEWELRY FAIR

MATERIALS
SCIENCE
(GEMS&JEWELRY)
PROGRAMS



A study on the potentiality of making acetate cellulose jewelry from used cigarette filters

Prangrada Sakulnok, Weerachai Janmanus, Supattra Chanwanichkit

Advisor : Asst. Prof. Dr. Natthapong Phinichka

ABSTRACT

An estimated 9.9 million people in Thailand smoke cigarettes. Around 95 million cigarettes were smoked per day leading to numerous amount of cigarette filters were discarded. 95% of cigarette filters are made of cellulose acetate and it takes around 10-15 years to degrade. As a result, the goal of this work is to look into the possibility of converting used cigarette filters into costume jewelry. In this experiment, smoked cigarette filters were collected, cleaned, and bleached by chemical process after that they were dissolved by using solvents and finally adding a synthetic dye as the last process. Experimental results showed that by cleaning the smoked filter with boiling water, glycerol, ethanol, and also bleached, with NaOCl 5wt%, NaClO₂ 4wt%, and H₂O₂ 2.5wt% respectively the best white color can be obtained. SEM images showed that, after cleaning and bleaching process, the fiber in the filter had not changed from their original form. Water Retention Value (WRV) test revealed that the cleaned cellulose acetate from cigarette filters absorbed more water than the used ones. The results of dissolution showed that the clean filter also dissolved better in acetone than acetic acid. When formed into a piece of film and analyzed by using XRD, no difference found between cleaned and new cellulose acetate from cigarette filter. In terms of tensile testing and the endurance of color in an artificial sweat test, found that the piece of film was enduring enough for costume jewelry development.



Adsorption of silver ions using chitosan/bamboo charcoal composites

Tanamon Tharmornpark, Thunyatorn Lalidaphanchai, Pacharawan Taecharoen

Advisor : Dr. Thanut Jintakosol and Dr. Walaikorn Nitayaphat

ABSTRACT

Chitosan/bamboo charcoal composites were prepared by blending chitosan with bamboo charcoal and forming composite beads. The composites were used as Ag ion adsorbent. Adsorption equilibrium experiments were carried out as a function of contact time, bamboo charcoal concentration, pH value, and adsorbent dosage level. The contact time of adsorption was founded to be 180 minutes. Composite adsorbent had the highest adsorption efficiency when the amount of bamboo charcoal was 50% of chitosan weight. The maximum Ag ion removal took place at the initial pH value of 10. The optimum adsorbent dosage for removal was 4g. Under above optimal conditions the maximum removal was 100%. The desorption of composite bead was 24.14% at pH 4. SEM and EDX micrographs show that Ag ions were adsorbed onto the adsorbent surface.



Key words : Adsorption, chitosan, bamboo charcoal, silver

Ancient beads of wooden coffin civilization in the mountainous Regions of Pangmapha Maehongson.

Ms. Natamon Bavornyospiwat, Sunisa Homklin, Sumalee Danyutthapolchai

Advisor : Assoc. Prof. Dr. Seriwat Saminpanya

ABSTRACT

The study of ancient bead from Tumpheemanronglongluk (Coffin Cave) Pangmapha Maehongson and Tarpaya Sakaeo Sites aim to study the popular figure, technique, source and chemical composition influential the appearance. The general of bead were sampled for study in gemological analysis. Some of bead were sampled for study in UV-Vis, FT-IR, ED-XRF, LA-ICP-MS.

The result of study were 1. All of bead are glass (man-made) and Indo-Pacific type. 2. Probably used drawn technique to from Pangmapha and blue yellow green Tapaya beads, used wi technique to from black Tarpaya beads. 3. The cylinder shape were popular at Pangmapha and barrel shape were popular at Tarpaya district. 4. Pangmapha bead and blue yellow green Tapaya beads were transparent to semi-translucent , black Tarpaya bead were opaque. 5. Cu give color in blue beads, Fe, Cu give color in green beads, Fe, V give color in yellow beads, Fe_2O_3 ,Mn give color in black beads. 6. Beads from the two sources have a high possibility to transport come from India.

Keyword : Ancient Beads, Indo-Pacific, Tumpheemanronglongluk, Pangmapha Maehongson, Tarpaya Sakaeo.

Cause of color in Petrified Wood

Rattida Deepromkul

Advisor : Assoc. Prof. Dr. Seriwat Saminpanya

ABSTRACT

From study Cause of the forming color of Petrified Wood, the specimen was collected from 5 sources namely Banhinkaw Khon Kaen, Krokdeanha Nakhon Ratchasima, Neansanga Chaiyaphum, Bantak Tak and Myanmar. One sample contains more than one color. Petrified Wood includes color of white, yellow, orange, red, brown and black. Gem properties Analyze shown that all of sample have $RI=1.53$ and $SG= 2.5$ which was expected to Quartz. The Sample from Krokdeanha Nakhon Ratchasima and Myanmar have $RI=1.45$ and $SG=2$ that expected to Opal. The specimens were analyzed by Energy Dispersive X-Ray Fluorescence (EDXRF). All sample composed mainly of SiO_2 . The high concentration of Fe_2O_3 was found in brown Petrified Wood. From Laser Induced Breakdown spectrometer (LIBS) analysis, the result was concluded that cause of forming white color is Si, gray is Si,Ti, yellow is Fe, orange is Mn,Ti, red is Mn, brown is Mn, Ti, Fe, Ca, Al and black is Mn, Ti.



Feasibility study of the utilization of sugarcane bagasse cellulose for producing costume jewelry

Rinrada Sriphathoorat, Valeerat Borvornjatuwich, Anyarat Khadcheung

Advisor : Asst. Prof. Dr. Natthapong Phinichka

ABSTRACT

The aim of this work is to study the possibility of using sugarcane bagasse cellulose for producing costume jewelry. Dissolving pulp can successfully be made from sugarcane bagasse by chemical process under controlled pH and temperature condition. The pulp was analyzed by scanning electron microscope (SEM), measured degree of polymerization (DP), determined the amount of holocellulose, and finally measured CIE whiteness. The results showed that sugarcane bagasse dissolving pulp has 98.8% holocellulose and its DP is 2198 with CIE whiteness equals to 81.54. Pulp was then dissolved by using both Xanthate and NaOH-Urea process and after that coagulated in 5% H_2SO_4 aqueous solution to form regenerated cellulose (RC) film. The results from x-rays diffraction confirmed that the obtained regenerated cellulose film is cellulose II. The strength of the film was measured by Universal Testing Machine. Yield strength of RC film from xanthate process and NaOH-Urea process are 23.56 and 12.22 N/mm^2 respectively. This can be suggested that RC film from xanthate process is more suitable for producing costume jewelry. Therefore, it was selected to dye with reactive dye for improve its appearance.



Geomorphology of civilizations coffins in Pang Ma Pha district, Mae Hong Son Province.

Wachira duang-aum and Pimmada sirisalipoch

Advisor : Assoc. Prof. Dr.Seriwat Saminpanya

ABSTRACT

Education landform of civilization coffins in Pang Ma Pha district, Mae Hong Son Province Topic has 2 main objectives: 1. Study Geomorphology of the space and in the cave to describe the general nature and nearby areas. 2. Study micromorphology and Mineralogy of Phi Man Long Long Ruk cave. This collected from the study of map, Landsat, survey area and collected samples to analyze with the tool. Including analysis of thin section with binoculars, Analysis with X-ray fluorescent, Analysis with X-ray Diffractometer and Analysis with Scanning electron microscopic. Characterization of geological The Pang Ma Pha consists 3 categories of igneous sedimentary rocks and metamorphic rocks. Phi Man Long Long Ruk cave supported by sedimentary rocks limestone types Ratchaburi is the Permian limestone and the age of 280-230 million years. Geomorphology of is karst limestone consists a lot of cave, Sinkhole and cliff. Samples from the study area to XRF analysis showed that the main component is the CaCO_3 very high purity- impure (99.73 to 65.47 wt% of CaCO_3) Rock type is limestone to limestone magnesium. Studies with a thin section with binoculars found fossils of two species are brachiopod and fusulinids which is prior to age extinctions in the Permian, which is consistent with data from studies maps and landsat. Both types of fossils live in the calm shallow sea. Assuming the limestone support area precipitate in the shallow waters in the early Permian. Analysis of samples from Phi Man Long Long Ruk cave by XRD mineral found in all mineral Calcite has sparkling at some point. Has led to studies by SEM showed that the crystals precipitated calcium in two forms Including Granular and Sheif. Crystallization consecutive plane approximately 300-500 microns, which will cause the reflected light in different degrees is cause of the sparkling of the calcite.

Improve the surface hardness of lead crystal glass for jewelry applications

Krongkaew Suwanboribarn, Anyarat Pattarapuree, Rujiporn Busabok

Advisor : Dr. Anocha Munpakdee

ABSTRACT

This research aims to improve the surface hardness of crystal glass by adding modifiers of 10-20 wt% CaO, 10-20 wt% BaO, 2-6 wt% TiO₂ and/or 2-6 wt% ZrO₂ using the conventional melting method. The glass compositions were melted at 1400 °C for 2 hours with a heating/cooling rate of 10 °C/min. After that, the molten glass was casted to the bar shape on a hot plate and annealed at 450 °C for 2 hours. Then the glass bar was cut to a thin slice using a diamond cutting machine and polished to a mirror finish. Reflective index, specific gravity and surface hardness of the specimens were measured using the refractometer, density determination kit mode AD-1653 and Micro Vickers hardness tester, respectively. The results indicate that all modifiers increase surface hardness of the crystal glass. Moreover, there was an increase in hardness up to 539 HV and reflective index up to 1.62 when adding 20 wt% CaO to the crystal glass.



Mystery of Dvaravati's metal ornament technology

Chanita Sukpom, Aungsana niyomrat, Apakorn Palakawong Na Ayutthaya

Advisor : Assoc. Prof. Dr. Seriwat Saminpanya

ABSTRACT

The purpose of this studying is to study about the history and processing technology of bronze jewelry in Amphoe Ta Phraya, Sa Kaeo. The studying methods are following

1. Collect the secondary data
2. Analyze the element by X-ray Fluorescence (XRF), Electron Probe Micro Analyzer (EPMA) and Inductively Coupled Plasma-Optical Emission Spectrometer (ICP-OES)
3. Analyze microstructure by Microscope

In our example, there are three examples; the bracelets are pieces 1 (L), big bracelets parts pieces 2 (R), and a bracelets small (S).

From the result of studying show that bronze jewelry age is at least 2500 years. The major element of bronze that we found is copper (85-90%) and the minor element is tin. Moreover, we found that bronze also has other element such as Fe ,Pb ,Ag, and Zn (0.031%). From the result of ancient processing technology analysis, we found that in ancient times they produced the jewelry by using the casting process, because we found the microstructure that we called “Dendrite”- Atoms have combined quickly and alloy is cooling at the same time.

Optical properties of Antimony Tin Oxide (ATO) thin film by sparking

Chatchai Uswasdenpaisan, Natakorn Siriruangsakul, Pilun Akarawatcharangura

Advisor : Dr. Thanut Jintakosol

ABSTRACT

This research has been study optical properties of Antimony doped tin oxide (ATO) thin films on glass substrates by Sparking process. The sparking off two metallic alloys tip by direct current in air at atmosphere pressure. Therefore, the air molecules were ionized and accelerated to collide with the metallic alloy tips and deposited on a glass substrate. The films were annealed at temperatures of 300, 400 and 500 °C for 1 hour and examined thin films nanostructure by Atomic Force Microscope, the surface structure by Scanning Electron Microscope, optical properties by UV/VIS Spectrophotometer and structural features were characterized by Raman Spectroscopy. From the results, it is showed nanoparticles structure of ATO thin films on glass substrate. The absorbtion increase with an decrease concentration of antimony. After annealing at temperature of 300, 400 and 500 °C for 1 hour. Annealing probably to improved crystallinity of the films. Increasing the annealing temperatures, the optical absorbtion was decreased

**Petrography and Geochemical of Unsolided Sediment at Longlongrak cave,
Prangmapha district, Maehongsorn province.**

Patteera Alaisuk, Worawee Mitaumpan, Chanon Dangsepon

Advisor : Assoc. Prof. Dr. Seriwat Saminpanya

ABSTRACT

The purpose of this research was to identify how sediment precipitated. The project is part of Petrography and Geochemical of Unsolided Sediment at Longlongrak cave, Prangmapha district, Maehongsorn province.

A research result indicated that there was reddish brown sediment which combined with sand at the top of cave. However, the sediment, at the bottom of cave, was clay and consisted of many minerals that are called Quartz and Kaolinite. The sediment had high chemical index alternation and a result of trace element testing showed that sediment consisted of chemical element. The chemical element can specify the sediment origin which was originated from mafic rock, type of igneous rock. The mafic rock is one of Basalt and Gabbro that is part of the lower crust, SIMA.

Pottery of coffin cave in the high land area of Pang Ma Pha, Mae Hongson

Panita Laemtongprateep, Thanasorn Singtis, Arunrat Sabram

Adviser : Assoc. Prof. Dr. Seriwat saminpanya

ABSTRACT

This research is to analyze of pottery at Pang Ma Pha in Mae Hong Son province. The objective of study two issues: 1. To study species composition of the clay used in the manufacture of pottery from Mae Hong Son and Sra Kaew. 2. To study techniques for burning pottery and type of kiln. By choosing to compare pottery from two sources, including pottery from Pang Ma Pha, Mae Hong Son's four samples and Klong Num Sai, Sra Kaew's four samples.

The result show that pottery from two sources are different found in minerals of Pang Ma Pha, Mae Hong Son are poor grain size. That didn't choose size before used and mineral was angle shapes. In part minerals of Klong Num Sai, Sra Kaew are well grain size. The main components have quartz and iron but different as pottery from Pang Ma Pha, Mae Hong Son, there are calcite, kaolinite, microcline and muscovite which don't transform at high temperature. While pottery from Klong Num Sai, Sra Kaew found that converged on high temperature such as mullite, which was changed from kaolinite up to 980°C and cristobalite changed from quartz at 1200°C. Which concluded that the pottery from Pang Ma Pha, Mae Hong Son is burnt up to 800°C is expected to use an Open-air-Firing. The pottery of Klong Num Sai, Sra Kaew is expected to burn up to 1200°C using a thermal burn up and the two source are same formed by wheel throwing but found decorated are different from pottery of Pang Ma Pha, Mae Hong Son are decorated with striped cord and pottery from Klong Num Sai, Sra Kaew are decorated with polished it.

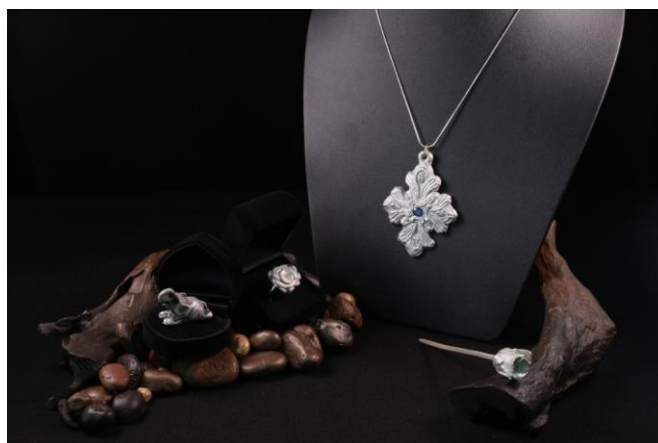
Production of silver clay for jewelry applications

Nuttamon Boonsermsukcharoen and Wanida Nonthathi

Advisor : Dr. Anocha Munpakdee

ABSTRACT

It was stated in this research that the silver clay was produced by mixing the large and small sizes of silver powder at a composition of 60-80% and 20-40% by weight with 8-15% of Cellulose, 0.01-0.2 ml. Polyethylene glycol, 1-2 ml. Polyvinyl alcohol, 0.01-0.1 ml. Oil, and 2ml. distilled water. These mixtures were blended thoroughly to form a specimen. They were then placed for sintering at 600-750 °C for 2 hours. The specimens were tested for linear shrinkage, density and hardness using vernier caliper, density determination kit modal AD-1653, and the micro hardness tester (model Vickers Shimadzu HMV2 TDA), respectively. The results showed that linear shrinkage, density and Vickers hardness are likely to increase at higher sintering temperature and improve their properties. The optimum composition of the specimen in this research is 70wt% large-sized and 30wt% small-sized silver powder with 8% of cellulose.



The study of manufacturing factors affect the quality of the lead free niello inlay

Sirichaya Hongchindapong and Adiphat Kummaraphat

Advisor : Asst. Prof. Dr. Kageeporn Wongpreedee

ABSTRACT

Thai nielloware is an invaluable old craftsmanship. Niello is a black mixture of lead, copper, and silver, used as an inlay. Because lead is the main component, it affects trade barrier and cannot be exported to international markets. Although the nielloware production has been developed without lead filled and passed on generation to generation, the lead free niello inlay production cost are high. Therefore this research is the study about the effect of lead free niello inlay manufacturing process factors of lead free niello inlay quality. We use two different qualities of copper (99.98percent of copper and 99.99 percent of copper oxygen free) , three different reheat processes (reheat at 350 Celsius degree in 1 hour and 3 hours) and five formulas (decrease composition of silver) of lead free niello inlay used in this research. Research studies usability and viscosity of niello inlay by artisan. The result show that two quality of copper can use in niello inlay product , the niello inlay without reheat process is better than do the reheat and the composition with the 3.5 percent of silver weight is the best to use.

The study of physical and optical properties of heat-treated Tanzanites.

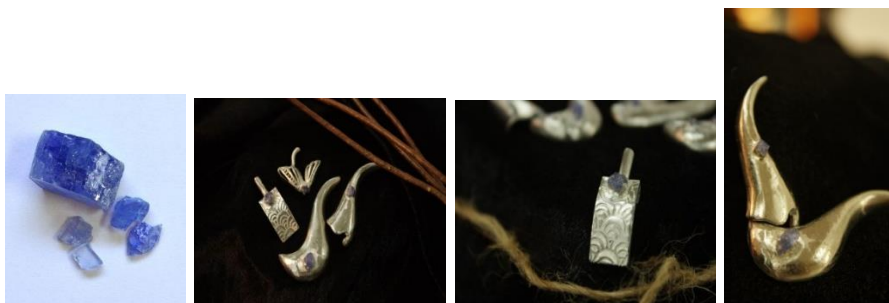
Pawittra Hotrawaisaya, Thadarat Wongchaisri, Yardthip Phadungwittayakorn

Advisor: Dr. Bongkot Phichaikamjornwut

ABSTRACT

Tanzanite is yellowish Green, greenish Yellow and Purple colored in Zoisite species. The heat treatment changed their colored to violetish Blue colored like Blue Sapphire. The process using 500, 600, 700 and 900 degree celsius in oxidation and reduction conditions. Tanzanite samples changed their colored when heat-treated at 500, 600 and 700 degree celsius in oxidation condition, but unsuccessful for 900 degree celsius in reduction condition.

The UV-Vis-NIR showed the absorption band of V^{3+} at 380 nm and 530 to 750 nm and OH^- peak at $3150-3250\text{ cm}^{-1}$ from FTIR was decrease. After heat-treated, Tanzanite samples more transparency because minute particle inclusion was disappear. The heat-treated tanzanite will add the value and develop to stone in place in gem and jewelry industry.



Key words : Tanzanite, Heat treatments, Physical and optical Properties

The study of possibilities to synthesis glass ceramics-composite imitated opal

Nisa Nhongsaeng, Phenprapa Prysaward, Alisa Tran

Advisor : Dr. Duangkhae Bootkul

ABSTRACT

Glass-Ceramics composite materials are produced through controlled crystallization of base glass called “controlled crystallization”. Glass-ceramics have an amorphous phase and one or more crystalline phases thus this materials share the properties of both glass and ceramics. The purpose of this research was to produce glass-ceramics materials which are opal-like appearance from recycled glass, silica powder, titanium dioxide, and coloring oxide. The recycled of soda lime glass (SLG) is used as main raw material as a matrix and the others as a reinforce, The glass powders are prepared by crushing to 44 microns of particles size. The SLG powder are then mixed with other raw materials according to the ratio of SLG to silica powder to titanium dioxide to zinc oxide to other varied coloring oxide of 60:35:2:2:1 wt.% and 55:40:2:2:1 wt.%. The glass ceramics sample are fabricated into alternated layers followed by coloring oxides in raw materials compounds by using uniaxial pressing and cold isostatic pressing with constant pressure at 15 ton per square inch. Sintering process is conducted at different temperature from 1000°C to 1150°C with 4 to 6 hrs holding time, there are several changes in terms of shape, color and appearance after sintering process, The condition which made the best result in term of color and appearance to produce glass-ceramic material for Opal costume jewelry application is 60:35:2:2:1 wt.% with 1000°C and 4 hr. holding time.



Key words : Glass-ceramics, Opal imitated, Composite materials

The study of suitable temperature for stone in place casting of Tsavorite and Tanzanite

Narubed Sorsrisakorn and Paweenwat Bumphenkiattikul

Advisor: Ass.Prof.Dr.Kageeporn Wongpreedee and Dr.Bongkot Phichaikamjornwut

ABSTRACT

Modern stone in place casting techniques are able to be performed on precious stones since they have more ability to withstand high casting temperatures than semi-precious stones. Furthermore, Tsavorite and Tanzanite are becoming more and more popular in the gem market, which builds up our interest to study the suitable temperature for stone in place casting of Tsavorite and Tanzanite. The study uses casting temperatures between 350°C-450°C for Tanzanite and 600°C-700°C for Tsavorite in order to find the most suitable casting temperature for each of the precious stones. The result shows that Tanzanite can be casted at a temperature not over 450°C, if the temperature exceeds that, the stone would start to change color which is caused by prior heat treatment to enhance its quality. Also, when using high temperature, inner inclusions such as liquid or crystal tends to expand under oxygen deprivation state and causes damage to the Tanzanite. Tsavorite, in the other hand, is able to withstand stone in place casting temperature of over 700°C and can be accompanied with high melting point metals.



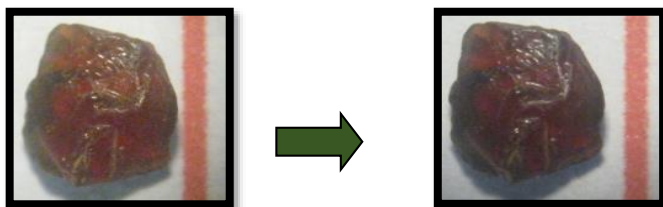
The study on possibility for quality improvement of brownish red garnet using implantation technique

Suarporn Phuangmalai, Kamonrat Phungdang, Naana Charernrat

Advisor : Dr. Duangkhae Bootkul and Dr. Amornmat Keeratisin

ABSTRACT

Red gemstones have always fascinated people as ruby and spinel. By the term 'red garnet' is the color most often encountered than brownish red garnet thus various enhancement methods have been applied on them. Ion implantation technique has been applied on brownish red garnet samples as a new gem enhancement method. Technique is implanted the particles on the materials, it can improve the quality of gemstone; therefore this technique is a non-destructive technique because this technique is the high energy and low heat the gems. In this study, 1 type of ions is used: Nitrogen (N^+). In part of implantation of Nitrogen ion (N^+) at dose 70 keV for 60 minutes could improve both clarity and color of garnet samples that brownish red garnet become red. This technique could be improved gems 58.75% of the samples.



The study of bismuth shapes effecting to the accuracy in Fire Assay without Lead.

Bismuth was lately researched to replace lead in Fire Assay process however the errors of proof-purity were in the range of $\pm 0.05\%$ which is not meet the error range of ISO standard. This experiment studied bismuth forming process in three different ways which were named Bismuth formula A, Bismuth formula B and Bismuth formula C. All bismuth samples were trail on 96.33% gold to analyst by Fire Assay methods. From the weigh calculation according to ISO 11426:1993 standard, the results showed that Bismuth formula C revealed the smallest error amount of $\pm 0.02\%$. The microstructure of metal pellets and metal sheet by using SEM and EDS equipped in the machine observed the residue of copper on the surface. Nonetheless, the copper were disappear after etching of final stage. The results of cupel analysis by using XRF machine were found that bismuth and copper were absorbed at the center of cupels.

By Kwanmada Peumsiriwassana, Pitchaporn Sangkaew and Pornsub Anyurekul

Advisor Asst.Prof.Dr. Kageeporn Wongpreedee

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Change colorless beryl to pink beryl by gamma-irradiation and heat treatment.

In this study, colorless beryl samples have been treated by gamma-irradiation and heat treatment. Before treated by gamma- irradiation, colorless beryl samples showed UV-Vis spectra peak at 817 nm due to Fe^{2+} absorption in Al^{3+} octahedral site which would not affect the color of beryl. After gamma- irradiated at 500, 1,000, 2,000 kGy, respectively, colorless beryl samples changed into heliodor (yellow beryl). They showed peak at 315-350 nm which corresponded to the peak of Fe^{3+} absorption due to electron jump from Fe^{2+} to $\text{Fe}^{3+} + e^-$. Therefore, these causes of color center at Al^{3+} octahedral site then, samples have been heated at 500°C for 1 hour, the samples changed back to Goshenite (colorless beryl) and they showed peak at 817nm due to Fe^{2+} absorption reappeared.



By Jiraporn Ratpiyapaporn and Thanat Khongmueng

Advisor Dr. Amonmat Kiratisin

The suitable temperature for stone in place casting using grossular garnet

Stone in place casting using semi-precious stone (grossular) and sterling silver were consider the highest temperature in perforated flask and also their inclusion especially liquid inclusions that damaged stone after casting. The suitable temperature for grossular on stone in place casting process is 600 °C. Liquid inclusions such as feather, fingerprint and small internal fracture were enlarged after increasing temperature more than 600 °C. After stone in place casting process, the FTIR spectrum pattern of hydroxyl group ($3400 - 3700 \text{ cm}^{-1}$) were decreased. The UV-Vis-NIR spectrum showed the absorption of Fe^{3+} at 369 and 432-435 nm. The chemical analysis using EPMA can calculated their end-member: $\text{Gr}_{89.1-89.9} \text{An}_{8.2-8.7} \text{Py}_{1.7-1.9}$.



By Apichaya Buathong, Sasipa Yohsoongnern and Tirajittree Jangkum

Advisor Dr. Bongkot Phichaikamjornwut,

Co-advisor Asst.Prof.Dr. Kageeporn Wongpreedee

Influence of binders on the physical and mechanical properties of copper clay.

Copper clay consists of microscopic particles of copper ($\leq 45 \mu\text{m}$) suspended in an organic binder, surfactant and oil. A clayish composition is made of a kneaded mixture until it becomes homogeneous. It can be sculpted, textured, molded or carved into a wide range of pieces such as jewelry and craft designs. Copper clay has a high green strength and it can be rolled into sheets and rods. After copper clay was fired for 2 hours in activated carbon at 800 - 1000 °C, the organic substances were burned away and copper powders were sintered to form a solid copper metal. The percentage of pure copper in the clay mixture is 90% (by weight) and the remainders are moisture and organic binders. As a result, the linear shrinkage was 12 - 41%. The longer the firing time, the smaller the metal piece became. The densities of the specimens were between $6.259 - 8.791 \text{ g/cm}^3$ (69.85 - 98.11% of theoretical density) and the surface hardness is approximately 62 - 70 HV. The results suggest that the copper piece made from this method can be sawed, drilled, sandblasted or soldered like the piece formed by the conventional copper casting process.



By Sarita Chanjirawittaya and Thanrada Onin

Advisor Dr. Anocha Munpakdee

The effect of Bi_2O_3 and B_2O_3 on the physical and optical properties of lead-free vitreous enamels.



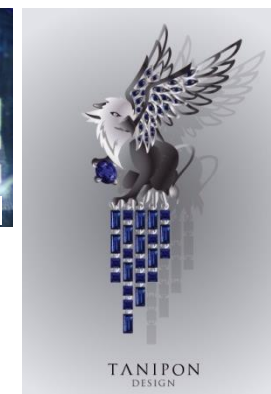
Vitreous enamels on jewelry pieces have made jewelry more attractive. Enamels (fired glass powders) were fused at the temperature between 750 to 850 °C in order to produce lustrous and colorful enamels. Lead-free enamel was produced by fusing raw materials, which consist of 30g SiO_2 , 20g CaO , 5g Li_2O , 15g Na_2O , 5g K_2O , 5g BaO , 2g Al_2O_3 , 2g TiO_2 , 2g ZrO_2 , 10-30g B_2O_3 and 5-20g Bi_2O_3 at 1200 °C for 2 hours in the furnace, and then pouring the molten glass into a steel plate or in water to obtain an enamel. The results were shown that enamels obtained from this method have the specific gravity of 2.61-2.74 and the reflective index of 1.58-1.64. By increasing the amount of Bi_2O_3 , the specific gravity and the reflective index of enamels were increased. However, adding B_2O_3 to the mixture decreased the specific gravity and the reflective index. Moreover, enamels have the Moh's hardness of 4 to 6 and are shining and transparent like glass.

By Puttipong Okwaeha, Suphabhorn Thanyot and Wasana Pengsuk

Advisor Dr. Anocha Munkdee

The Study Of Inclusion Changing In Den Chai Blue Sapphire, Phrae Province, After Stone In Place Casting Technique.

The treated blue sapphire using Ion Implantation and heat treatment techniques were studied their inclusion especially liquid inclusions after stone in place casting. After ion implanted, the experimental results showed liquid inclusions such as feather and fingerprint were less changed than heat treated which is expand and/or transform. Otherwise, the stones after both enhancements, their liquid inclusions did not change after stone in place casting anymore, but some sample showed iron stain. The chemical analysis using EPMA showed high content of FeO 0.4-1.0 wt% Oxide.



By Apichanun Romlamduan, Chatlada Nilasithsathaporn and

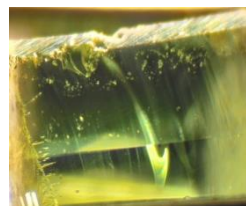
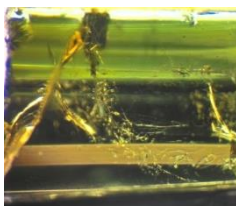
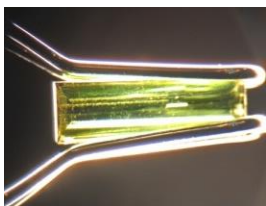
Maewadee Khumpitak

Advisor Dr. Bongkot Pichaiakamjornwut,

Co-advisor Asst.Prof.Dr. Kageeporn Wongpreedee and Dr. Duangkhae Bootkul

The Study of Chrome Tourmaline Enhancement Using Oxygen Plasma Annealing And Heat Treatment Techniques.

The study of chrome tourmaline treatment using oxygen plasma annealing and ion implantation techniques compared with heat treatment at 450 and 550°C. All inclusions in tourmaline samples did not change after oxygen plasma annealing and ion implantation techniques. The absorption band of UV-Vis-NIR spectroscopy found Mn^{2+} at 415 nm and Fe^{2+} at 700 nm that confirmed the cause of color in green tourmaline. The hydroxyl group was detected by FTIR spectroscopy that found OH-stretching at $3400 - 3700 \text{ cm}^{-1}$ and 5200 cm^{-1} is H_2O and all spectrum were decreased after treated. The chemical composition of green tourmaline is $\text{Na}_{0.79} \text{Ca}_{0.08} (\text{Al}_{1.70} \text{Fe}_{0.77} \text{Mn}_{0.14} \text{Mg}_{0.05}) (\text{Al})_6 (\text{BO}_3)_3 \text{Si}_{5.76} (\text{OH})_4$ which analyzed by EPMA. By the way, the heat treatment is on process.

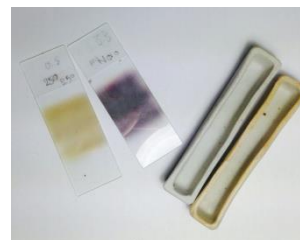


By Monthita Dermtumrum and Supanuch Yipsaengthong

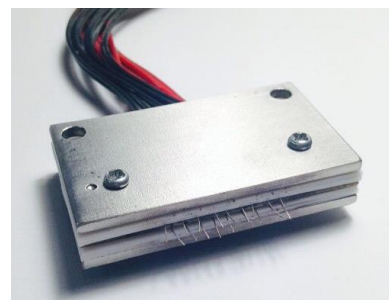
Advisor Dr. Bongkot Phichaikamjornwut,

Co-advisor Dr. Duangkhae Bootkul

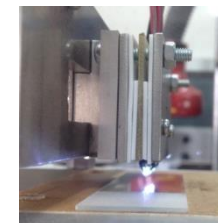
Synthesis of silver nanoparticle by Sparking process.



effect of silver nanoparticles on their structure and optical characteristics were investigated. The optical properties of the nanoparticles by Raman spectroscopy and UV-vis spectrophotometer. The morphology of silver



Silver nanoparticles were synthesized by sparking process. The nanoparticles were continuously deposited onto the substrate by varying the number of sparking cycles ranging from 100-200 and the deposited nanoparticles on glass slide were subsequently annealed at 250°C and 500°C in tube furnace under air atmosphere for 1 hour. The



nanoparticles was characterized by Scanning Electron Microscope (SEM). From the experimental data, Nanoparticles are annealed. Which the diameter of sample is decrease and silver oxide have been decomposition effect of nanoparticles have been a perfect form.

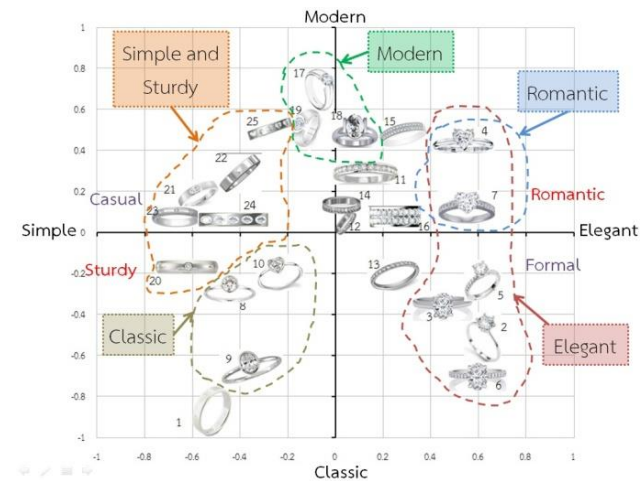
By Jirachaya Chan-in, Praephan Perchvanichkul and Ranuga Kerdjaroenporn

Advisor Asst.Prof.Dr. Thanat Jintakosol

Absorbtion of silver ions using chitosan/ montmorillonite composite.

Chitosan/ Montmorillonite composites were prepared by blending chitosan with montmorillonite and forming composites beads. The composites were used as silver ion (Ag^+) absorbents. The composites were characterized using XRD and Zeta potential measurements. Batch adsorption experiments were performed as a function contact time, chitosan montmorillonite concentration, pH value and adsorbent dosage level. XRD showed interlayer distance of montmorillonite observed from $2\theta = 6$ indicates the intercalation of chitosan into montmorillonite. The point of zero potential was obtained at about pH 7.5. The contact time of adsorption was founded to be 150 minutes. The composites adsorbent had the highest adsorption efficiency when the amount of montmorillonite was 3% of chitosan weight. The maximum Ag^+ ion removal was obtained at the initial pH value of 7. The optimum adsorbent dosage for Ag^+ removal was 1 g. The Ag^+ desorption of composite bead was 17.39%.

A study of the perception of foreign customers in the United States and Europe towards shapes of cubic zirconia and designs of silver rings.



This research aimed to study how designs of silver rings determined the human perception of silver rings with different shapes of cubic zirconia (CZ). Silver rings used in this study were found to be popular in export markets for some jewelry manufacturers in Thailand. Target customers in both the United States and Europe took part in this

study conducted using an online survey. They rated a scale of their feelings on each silver ring. The results indicated that bezel-set rings were perceived to be classic whilst tension-set rings were perceived to be modern. For both round and oval shapes of CZ in silver rings, target customers perceived the rings to be more formal and modern whilst the heart-shaped CZ in silver rings were perceived to be more romantic. These findings suggest that shapes of cubic zirconia and designs of silver rings influence the perception of foreign customers.

By Mathawee Meetan, Penvipa Srivichai and Vipakorn Seeboonruang

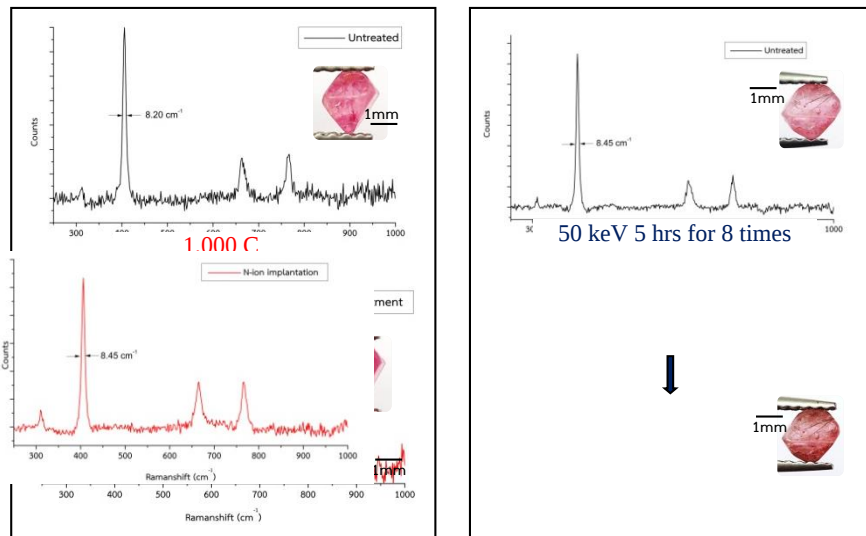
Advisor Asst.Prof.Dr. Thanat Jintakosol, Co-advisor Dr. Walaikorn Nitayaphat

By Kamolphon Tritasuk, Wasana Pengsuk and Woramonphan Thongsirichotchuang

Advisor Supinya Wongsriraksa

The ion implantation technique for natural pink spinel structure.

The preference of cations distribution of natural spinel was ordered in normal spinel structure. The energetics activity, including high temperature could be affected to the alternative arrangement of cations in the spinel structure and also would be known as inverse spinel. In this research, Ion implantation was also applied as an experimental method to enhance the essential qualities of the gemstones. The significant changing of natural pink spinel was occupied when implanted with the nitrogen ions at 50 keV energies for 5 hours and 8 times. The heavy ion beam irradiation led to the pink colors being changed into color distribution reddish pink more favorable ones. Responsible two absorption bands at 390 and 540 nm have been reported and associated with Cr^{3+} . The Raman spectra of natural pink spinel before and after implanted with nitrogen ion were directly affected to 405 cm^{-1} Raman shift with stable full-width-at-the-half-maximum (FWHM) values at around 8.45 cm^{-1} . Due to the recovered of the cations order spinel phase may exhibit in normal spinel structure, which is believed that it not differs from the initial normal spinel structure.



By Banthita Pinitchan, Thanyaporn Tengchaisri and Varissara Mongkolpetch
Advisor Dr. Duangkhae Bootkul,
Co-advisor Dr. Bhuwadol Wanthanachaisaeng

Petrography and Geochemical of Unconsolidated Sediment at Longlongrak cave.

Petrography and Geochemical of Unconsolidated Sediment at Longlongrak cave. The objective of sediment study at Long-Long-Rak Cave (in Pang Ma-Pha, Mae Hong Son Province) is the study of mineralogy, chemistry, process, and provenance of the cave sediment. The authors studied this sediment from themethodologies as soil description (by Binocular Microscope), particle size analysis (by Hydrometer Method), mineral compositions (by X-ray Diffraction(XRD)), major and trace elements (by X-ray Fluorescence(XRF)) and soil dating by Thermo Luminescence (TL Dating). The study helps archaeologist to investigate the ancient environment (paleoenvironment) , and to insist their archaeological records for better accuracy of the



interpretation in archaeology. The study results show the most cave sediment appear in reddish brown color and high portion of sand particles that separates the lower sediment layers which are composed of Quartz and Calcite minerals.

By Kitisak Baisukhan, Palida Thanyaantachai and Tipsuda Raksuwan
Advisor Assoc. Prof. Dr. Seriwat Saminpanya

The study of relation between the ancient shell beads with the giant clam.

The Study of relation between ancient beads and giant clams is the the experimental results of samples from Srakaew and shell beads giant clams to compare the relationship. The experiments will be study the gems and advanced analysis tools including Raman Spectroscopy to examine the mineral composition in the sample, Energy Dispersive X-ray Fluorescence Spectrometer to determine the elemental composition and Scanning Electron Microscope analysis of structural properties. The results of experiments with the same core elements was the Calcite and Aragonite and abundance of elements that are very close giant clams in the ocean, which confirmed the origin of the elements Sr, was found in testing samples in both groups. And physical characteristics can be demonstrated that the old shell beads were excavated in Sa Kaeo that was made from the bark of giant clams. This demonstrates the relocation of the community and dealing in ancient times.



Ancient shell beads from
Tubparab, Srakeaw



Ancient shell beads from
Raberkkarm, Srakeaw

By Bunthariga Poorananont and Parichart Thanasetthabumrung
Advisor Assoc. Prof. Dr. Seriwat Saminpanya

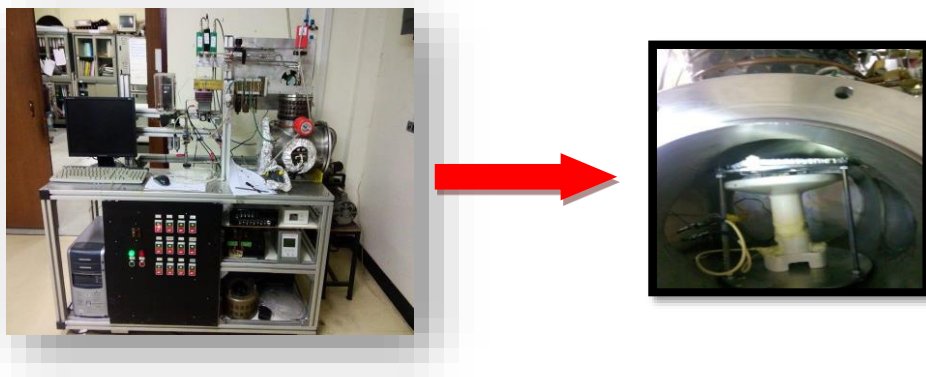
The ion implanted technique application for color enhancement of greenishBlue sapphire.

Natural Blue sapphires are colored by a combination of the trace elements Iron (II/III) and titanium (IV) in natural sapphires with their chromophore participation. Ion implantation technique experiments in vacuum system were carried out on such greenishBlue sapphires from Denchai district, Phare province, Thailand and Diago, Madagascar sources for the purpose of improving their color characteristics. A special attention is paid to spectral characteristics of chromophore centers. Behavior of the chromophore centers under nitrogen ion implantation treatment and their influence on the color of greenishBlue sapphires are studied. Color modification mechanism was proposed on the basis of UV-VIS-NIR of Fe^{3+} $\text{Fe}^{3+}/\text{Fe}^{3+}$, $\text{Fe}^{2+}/\text{Ti}^{4+}$ and $\text{Fe}^{2+}/\text{Fe}^{3+}$ spectral analyses data. The Nitrogen Ion implantation technique allows improving Blue color characteristics and gemstone quality.

By Nusara Naungkeaw, Phanchita Peerapisalpol and Siripat Wiriyachliaoek
Advisor Dr. Duangkhae Bootkul, Co-advisor Dr. Bongkot Phichaikamjornwut

Optical Properties Enhancement for blue sapphire Den Chai district Phrae Province by Oxygen Plasma Annealing Technique.

Natural Blue Sapphires quality is one of interesting and valuable gemstone. This research reports the optical properties modification of semi-translucent and dark blue sapphire from Denchai district, Phare province. The applicability of Ion implantation and Oxygen Plasma Annealing technique were applied as an effective method on gemstones enhancement for transparency modification. Nitrogen ion implantation has been carried out to serve as the cause of improvement of blue color features for 50keVfor 5 hours. Consequently, the oxygen plasma was applied at 100°C annealing at fixed flow rate for an hour to gemstone. The Additional experiment results comparable the oxygen plasma at fixed flow rate 200 and 400 cycles respectively. Resulting significantly transparency data were increased10% and 15% transparency using flow rate of oxygen plasma at 200 and 400 cycles from the initial blue sapphire.



By Lanicha Yossombat, Phakamas Chunthaphom and Pornteera Buranasatian
Advisor Dr. Duangkhae Bootkul

A comparative study between the lead-glass filling and no additive heat treated corundums by electric furnace.

Ruby and Sapphire are gem corundum. Low quality stones can be enhanced to increase their value by means of heat treatment with lead-glass additives to fill the cracks or blemishes. The samples of this study include ruby (Madagascar), white sapphire (Madagascar), green sapphires (Kenya and Somalia) and green star sapphire (Thailand). We heated the samples with electrical furnace with to sets: 1) with the additives and 2) without the additives under the atmospheric



condition and 1,180°C for 12 hours. We found that the cracks of the sample have been filled by the lead-glass and the samples look brighter and clearer than the non additives sample. Lead-glass filled samples can be detected by using advanced techniques; SEM shows different tones between corundum host and lead-glass area; FTIR shows peak position of glass at about $6,259\text{ cm}^{-1}$ (Si-O-Stretching); EDXRF shows Si and Pb contents.

By Benjaporn Srisant, Jenjira Saefong and Kasina Jeerasiri
Advisor Assoc. Prof. Dr. Seriwat Saminpanya

The physical characteristics and chemical composition of gems. Carnelian beads from ancient tomb at Ta-Phra-Ya, Sakaeo, Thailand.

The main objective of this research is to study provenance of the carnelian beads excavated from the ancient tombs at Ta-Phra-Ya, Sakaeo, Thailand by comparison with the carnelian mined from Lopburi, Thailand. We analyzed the 21 samples by the use of gemmological equipments and advanced techniques (Raman microprobe and EDXRF). We found that the samples from the tombs are not the same population as the carnelian from Lopburi. This implies that the ancient beads might come from other geological environment than Lopburi or probably be imported from the other country which people in past traded with.



NPW: Ban Nongpakwan Amper Tapaya, Sa Kaeo

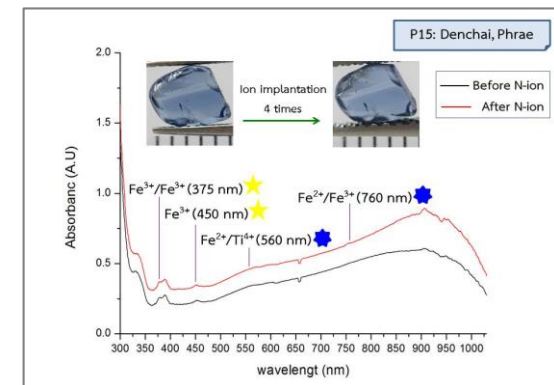
KP: Ban Khokplai Amper Tapaya, Sa Kaeo

HDL: Ban Huay Deelert Amper Chai Baadaan, Lop Buri

By Picharm Suksa-ard, Potchanart Katipong sanuwat and Rattansporn Tuywiang
Advisor Assoc. Prof. Dr. Seriwat Saminpanya

The Study of Optical Properties Enhancement of Blue Sapphires from Denchai, Phrae and Diego, Madagascar by Ion Implantation Techniques.

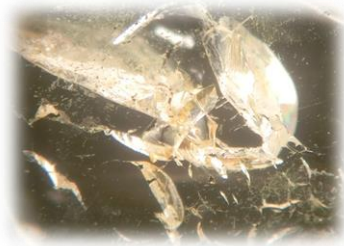
The aim of this research is Ion implantation techniques applied for enhancement of the natural blue sapphires from Denchai, Phrae and Diego, Madagascar. The N^+ ions were implanted onto the blue sapphire surface with 50 keV for 5 hours then carried on 400°C for 5 hours annealing. The results reveal increasing of clarity and saturated blue color. Moreover, there are all natural inclusions still remain.



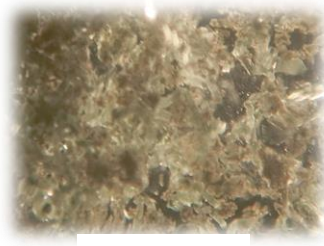
By Kunauma Rattanakampol Phatsinun Siri wattanakajorn Palapong Techo
Advisor Dr.Duangkhae Bootkul, Co-advisor Dr.Bongkot Phichaikamjornwut

Education inclusion in quartz at Banna-Banrai Tern ,Lampang.

Education inclusion in quartz or Pongkham at Banna-Banrai Tern ,Lampang. Study results showed that Pongkham have a many types. It have a beautiful and different identity that depend on physical of Inclusion in Pongkham such as Kaew-kab ,Kaew-puak ,Kaew-kon-lek ,Keaw sai etc. So inclusion have an important to categorize of Pongkham



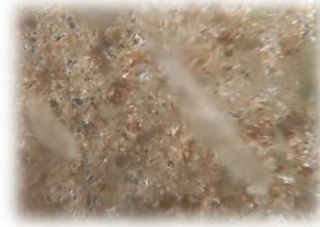
Kaew-kab



Kaew-puak



Kaew-kon-lek

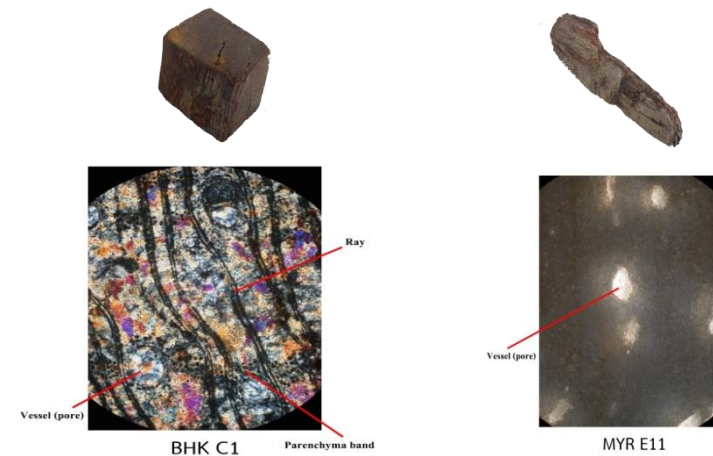


Keaw sai

By Narissara Archapetch, Sarathip sueyanyongsiri and Thanyakarn Pichedpaisan
Advisor Assoc. Prof. Dr. Seriwat Saminpanya

Trace element distribution in structure of petrified wood.

Petrified wood is a valuable resource. It is a wood that has turned to stone, been classified as fossil. The wood contains elements with different composition and quantity which are highly associated with preserve the wood structure. This study aims to identify and detect the elements that give the petrified wood variety of color ranges of colors by the use of different advanced techniques i.e. Optical microscopy, Raman spectroscopy and Electron Probe Microanalysis (EPMA). Raman spectroscopy result shows that there are "colorless" quartz and opal in the woods, but during petrification process some other contaminating elements are added to them and gives different intensity to the color of these clear crystals such as Mg Fe K Al Ca Ti Mn. The Electron Probe Microanalysis will detect the specific elements in the petrified wood.



By Bussara Suthannaviroj, Natveena Nannong and Thipvaree Suphataraphong
Advisor Assoc. Prof. Dr. Seriwat Saminpanya



RESEARCH PROJECT ABSTRACTS

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TOPIC

GEMSTONES

- (1) STUDY OF AMBER ENHANCEMENT USING TECHNIQUES OF HEAT TREATMENT
- (2) SLIGHTLY GREEN TOURMALINE ENHANCEMENT USING ION IMPLANTATION TECHNIQUE
- (3) CHROME TOURMALINE CLARITY ENHANCEMENT BY ION IMPLANTATION TECHNIQUE
- (4) THE GOLDEN DISPERSION ENHANCEMENT OF NATURAL COLORLESS SAPPHIRE BY NITROGEN ION IMPLANTATION TECHNIQUE
- (5) ION IMPLANTATION TECHNIQUE TO IMPROVE COLOR AND HARDNESS OF NATURAL TOPAZ
- (6) THE STUDY OF PINK TOURMALINE ENHANCEMENT USING GAMMA IRRADIATION TECHNIQUES
- (7) THE SUITABLE TEMPERATURE FOR STONE IN PLACE CASTING USING PERIDOT
- (8) COLORED STONE BEAD DIVERSITY IN GEMSTONE MARKETS OF BANGKOK
- (9) COLOR TREATMENT FOR PEARL BY NANO SILVER PARTICLES

DESIGN

(10) A STUDY OF THAI WOMEN'S PERCEPTION TOWARD LOVE SYMBOLS

(11) A STUDY OF CHINESE TOURISTS' PERCEPTION OF JEWELRY DESIGN

(12) A STUDY OF THE PERCEPTION OF THAI FEMALE CUSTOMERS
TOWARDS COLOURED CUBIC ZIRCONIA RINGS

MATERIALS

(13) THE DEVELOPMENT OF FORMING PROCESS OF CELLULOSE ACETATE
JEWELRY MADE OF CIGARETTE FILTERS

(14) THE STUDY OF DEVELOPMENT LEAD FREE NIELLO INLAY IN
COMMERCIAL INDUSTRY

(15) INFLUENCE OF BI AND IN ADDITION ON SN-CU ALLOY FOR JEWELRY
MANUFACTURING

(16) STUDY OF PROCESS IN MICROCAPSULE TO ODORIFEROUS AND COLOR
CHANGED FOR JEWELRY

(17) PROPERTIES ENHANCEMENT OF AG-CU-ZN SOLDER ALLOY BY ADDITION
SN

(18) ADSORPTION OF SILVER IONS BY SILK SERICIN

(19) THE STUDY OF PRODUCING ANODISED ALUMINIUM BRONZE JEWELLERY

GEMSTONES

THE STUDY OF PRODUCING ANODISED ALUMINIUM BRONZE JEWELLERY

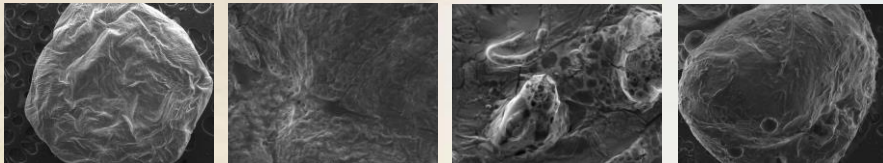
The aim of this research is to study the methods of anodising the aluminium bronze in order to produce the jewellery. The aluminium bronze samples were immersed in the electrolyte solutions of 10vol.% and 15vol.% sulfuric acid in which the voltages of 2 V and 2.5 V were applied for 5, 8, 10, 12, 15, 20 and 25 minutes. Different colours and the appearance of oxide layers on the aluminium bronze samples were obtained when various anodising conditions were applied. It was found that anodising the aluminium bronze sample in 15vol.% sulfuric acid solution at 2.5 V for 8 minutes gave the best result.



Sanruethai Sukhochaiyakij and Nutnicha Saengkam
Supinya Wongsriruksa

ADSORPTION OF SILVER IONS BY SILK SERICIN

Sericin, which is protein from silk cocoon, is natural material and highly efficient biosorbent. This research was to study about silver ion adsorption in silver nitrate solution by sericin protein is adsorbent which extracted from Nang Lai silk cocoon. Sericin protein was extracted by high pressure water degumming and then dried at 70°C. Sericin-alginate composite beads were formed by mixed with Na-alginate solution which the weight ratio of sericin to Na-alginate of 1:1, 2:1, 3:1, 4:1, and 5:1, respectively. Sericin-alginate composite beads were used as silver ion adsorbent. Adsorption equilibrium experiments were carried out as a function of weight ratio of sericin to Na-alginate, contact time, pH value, adsorbent dosage and silver nitrate solution concentration. Morphology was studied by SEM and EDS.



Nareeporn Thongkum and Kharnyakhorn Podettavikool
Asst. Prof. Dr. Thanut Jintakosol and Asst. Prof. Dr. Walaikorn Nitayaphat

STUDY OF AMBER ENHANCEMENT USING TECHNIQUES OF HEAT TREATMENT

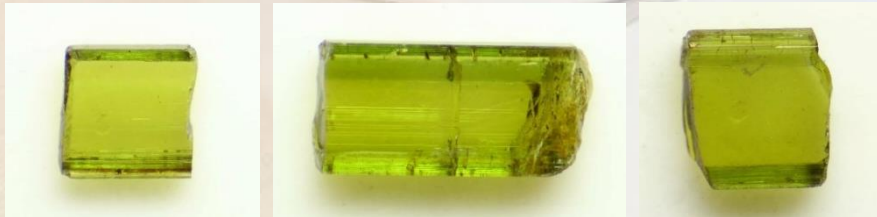
Heat treatment is normally used to enhance the color of natural ambers. Very slightly greenish-yellow ambers from Columbia were used in this studied. The samples were divided in three groups: gY2/4, gY3/1 and gY2/2 according to the GIA Color Master. The samples were cut and polished into squares with 2-mm thickness. The heating experiments were done using an autoclave, hotplate, oil and low-temperature furnace between 120-180°C atmospheric pressure. After the treatment in a low-temperature furnace, the amber samples turned saturated yellow (Y5/5). FTIR spectra did not show any peculiar peaks after the heat treatment.



Malinee Durongkawaroj, Methita Sangthong and Nutthapakorn Phantchai
Dr. Bongkot Phichaikamjornwut

SLIGHTLY GREEN TOURMALINE ENHANCEMENT USING ION IMPLANTATION TECHNIQUE

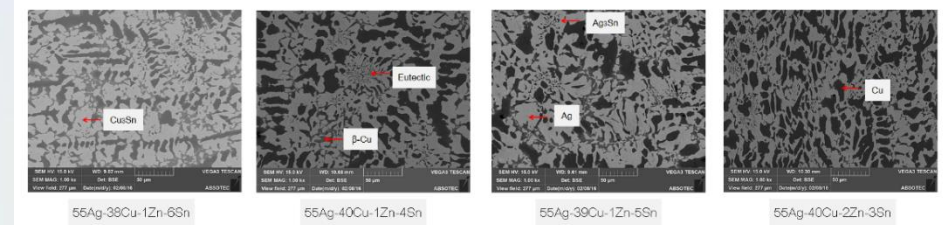
Plasma annealing and ion implantation are new techniques for gemstone enhancement. Slightly green tourmaline samples from Nigeria were used in this study. The stones turned saturated green colored after the enhancement. Liquid inclusions, such as, fingerprints, feathers, and liquid thin film, were enlarged, but not to the point that they would degrade the stones. FTIR spectrometer detected the hydroxyl group at $3400 - 3700 \text{ cm}^{-1}$ (OH-stretching) and 5200 cm^{-1} (H_2O) whose intensities decreased after the enhancement. UV-Vis-NIR spectra showed the absorption of Mn^{3+} at 415 nm and Fe^{2+} at 700 nm that confirmed the causes of color in green tourmaline.



Mananya Wararittichaii and Wasinee Treeworakul
Dr. Bongkot Phichaikamjornwut and Asst. Prof. Dr. Duangkhae Bootkul

PROPERTIES ENHANCEMENT OF AG-CU-ZN SOLDER ALLOY BY ADDITION SN

In jewelry industry, the soldering is importance part of it that this part has a lot of problems. Solder can cohesive to the one part and fix the surface from porosity problem. The Ag-Cu-Zn solder alloys was widely used in jewelry industry due to the advantages in mechanical properties and wettability. This research was studied microstructure and hardness properties of Ag-Cu-Zn by addition of tin (Sn). The solder alloy was investigated by using scanning electron microscopy (SEM) and micro-vicker hardness. The Microstructure of solder alloy after heat treatment was shown that lower melting temperature of solder alloy due to content of Sn, and form the structure of eutectic phase. The formation of Ag_3Sn and Cu_3Sn brittle compounds because the increase of tin. Micro-vicker hardness test show the Sn was increased, which hardness of solder alloys increased.



Uchukon Champaengchan, SaSi Rittisorntanoo and Amonpun Phiwatong
Asst. Prof. Dr. Thanut Jintakosol

STUDY OF PROCESS IN MICROCAPSULE TO ODORIFEROUS AND COLOR CHANGED FOR JEWELRY

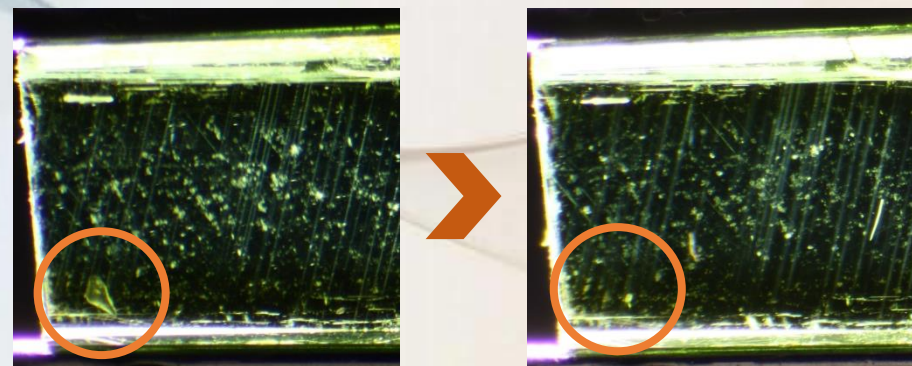
This purpose of this research is to explore the potential of utilizing microcapsule to make innovative odoriferous and color-changing jewelry. The method was conducted by cutting carnelian into cabochon shape and subsequently cleaned it with NaOH. Corrosion was then initiated by Hydrofluoric acid (HF) with 20% intensity which was mixed with water in various ratios. The analysis on the surface using microscope revealed that pickling HF and water with the respective ratio of 20:80 yielded the most effective result while maintaining the surface quality of Carnelian, with only 7% of weight loss for the 12 hours of experiment. Prepared mixture of microcapsule color and microcapsule aroma were afterward stirred in constant speed for 5 hours with the carnelian soaking in. The carnelian was then coated with odorless resin and the test found it to be able to change the color of gems in the temperature range of 20-50°C and would emit fragrance when touched as well as being tolerant to daily chemicals. Thus, this has great potential to be used in the making of jewelry.



Kamonchanok Wuttikun, Kajeerat Jumratsri and Ployok Nakpan
Asst. Prof. Dr. Thanut Jintakosol and Asst. Prof. Dr. Walaikorn Nitayaphat

CHROME TOURMALINE CLARITY ENHANCEMENT BY ION IMPLANTATION TECHNIQUE

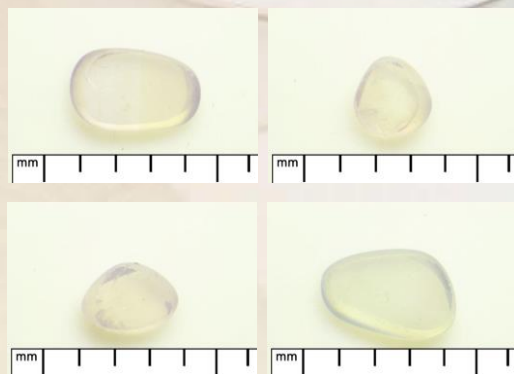
Low quality chrome tourmalines have been characterized by Particle Induced X-ray Emission (PIXE), UV-Vis NIR Spectrophotometer and high magnification gemstone microscope. Revealing in chemical composition, absorption spectra and inclusions. Nitrogen ion implantation technique able to reduce micro inclusions such as liquid, tube-like and 2-phase. The results reveal micro inclusions have been transformed disappear therefore, the quality enhanced without damage gemstone.



Nahathai Klaithong and Salinthip Sounthonpisatkarn
Asst. Prof. Dr. Duangkhae Bootkul

THE GOLDEN DISPERSION ENHANCEMENT OF NATURAL COLORLESS SAPPHIRE BY NITROGEN ION IMPLANTATION TECHNIQUE

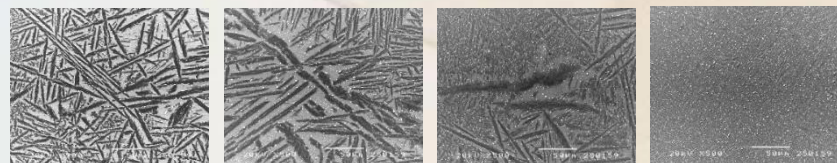
The samples in this research based on natural colorless sapphire from Vietnam origin. PIXE (Particle Induced X-ray Emission) analysis has given trace element of Ga_2O_3 and Fe_2O_3 to determine cause of yellow color and dispersion. The golden color enable successful enhancement by using ion implantation technique condition 4 hours bombard about 4 times. As the result of UV-Visible are revealed absorption Fe^{3+} at 350-400 nm. Relatively colorimeter analysis shows more yellow color and luster appearance. The possibly mechanism of Fe_2O_3 drive free Fe^{3+} substituted in Al^{3+} . Moreover, advantages of ion implanted can transform energy directly though sample without loss.



Chantip Nitayaprapa and Pongsirin Boontang
Asst. Prof. Dr. Duangkhae Bootkul

INFLUENCE OF BI AND IN ADDITION ON SN-CU ALLOY FOR JEWELRY MANUFACTURING

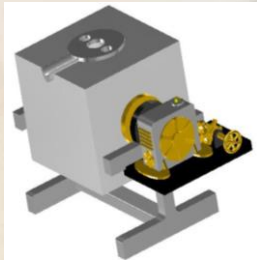
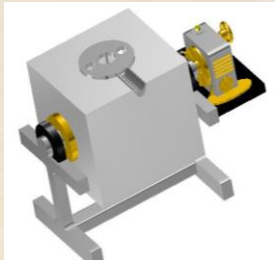
Sn-Cu alloy had been studied for jewelry manufacturing, but some properties reveal inappropriate for jewelry manufacturing. The influence of addition of Bi and In on microstructure and suitability for manufacturing jewelry of Sn-30Cu alloy were investigated. The microstructure feature of composite were characterized by scanning electron microscopy (SEM), and their suitability for manufacturing jewelry were evaluated at different type of jewelry casting. The result show that the proper addition of Bi and In have effect on the microstructure of Sn-30Cu. With co-addition Bi and In at some amount, the morphology of Epsilon-phase decrease its average particle size. Moreover, morphology of Epsilon-phase's particle size can be more decreasing with cooling rate control by using copper mold which had different thickness shape after melting. The average grain size can reach only 2-6 micrometer with more rapid cooling. The improvement of suitability for manufacturing jewelry is cooling rate and jewelry's thickness control.



Thanakom Suthabanthidpong and Pacharanamon Nonthapa
Asst. Prof. Dr. Kageeporn Wongpredee

THE STUDY OF DEVELOPMENT LEAD FREE NIELLO INLAY IN COMMERCIAL INDUSTRY

Nowadays, a production process of lead-free niello hasn't been controlled about quality and toxicity. This research aimed to examine the relationship between properties and qualities of lead-free niello and set up a machine that can produce high quality niello bar which should have needle-like microstructure. The first section, we have studied a microstructure of lead-free niello and we found that there are 4 different characteristics in the niello microstructure. We conclude that main factors causing incoherent grain are cooling rate and casting temperature. To control those factors, we decide to build a closed-system niello producing machine in order to reduce human errors in lead-free niello casting process.



Sittichai Whunsakul and Adiruj Peerawat
Asst. Prof. Dr. Kageeporn Wongpredee

ION IMPLANTATION TECHNIQUE TO IMPROVE COLOR AND HARDNESS OF NATURAL TOPAZ

The natural topaz is an important jewelry stone due to its high refractive index. Most topaz in commercial jewelry has been heated, irradiated or coated to improve its color and hardness. In this study present a novel technique to improve processes for applying a hard protective to natural topaz. Using Nitrogen Ion Implantation applied with heat treated at 200°C subsequently increasing time. The reaction of silica from topaz and nitrogen ion implanted to perform silicon nitride layer which is improved hardness by Nano indenter analysis. Magnificently, gem quality added as color and clarity of topaz enhanced.



Wasinee Kaittikrairat
Asst. Prof. Dr. Duangkhae Bootkul

THE STUDY OF PINK TOURMALINE ENHANCEMENT USING GAMMA IRRADIATION TECHNIQUES

Color enhancement of slightly pink tourmaline samples from Brazil and Mozambique using 400, 500 and 600 kGy of gamma irradiation (Co-60 were studied). The samples were cut and polished into two faces paralleled to the c-axis. After irradiation, the slightly pink tourmaline samples turned saturated pink. UV-Vis-NIR spectra of the samples showed the absorption of the color causing Mn^{3+} at 520 nm. Mn k-edge x-ray absorption spectra of the samples confirmed the shift of the Mn oxidation into a higher number after irradiation.



Pattrawarin Promsurin, Piyanan Boonjan and Wassana Ariyametta
Dr. Bongkot Phichaikamjornwut and Sorapong Poogkrapan

THE DEVELOPMENT OF FORMING PROCESS OF CELLULOSE ACETATE JEWELRY MADE OF CIGARETTE FILTERS

Cigarette butt waste is, nowadays, the world's number one litter problem. These come from consumers who smoke 96 million cigarettes per day. More than 5 trillion butts were estimated to be trashed each year. Not only discarded cigarette butts become litter, but also cigarette filters rejected from the machine become unusable waste. Our research focuses on how to use rejected cigarette filter rods from the production line as a main raw material for making costume jewelry. Cellulose acetate (CA) from cigarette filters were dissolved with acetone and mixed with different additives, talcum, calcium carbonate and polylactic acid (PLA), in order to improve their mechanical properties. In this experiment, PLA was dissolved with three different solvents, chloroform, chloroform-acetone and chloroform-acetonitrile, before mixed with dissolved cellulose acetate. It was found that PLA can dissolve faster in chloroform-acetonitrile than chloroform and chloroform-acetone respectively. The effects of the amount of added PLA in CA on the mechanical properties of cellulose acetate were also studied. The results show that adding 5% of PLA into dissolved CA could give the proper condition for casting costume jewelry, and the more PLA was added, the better the strength of the CA/PLA would be.

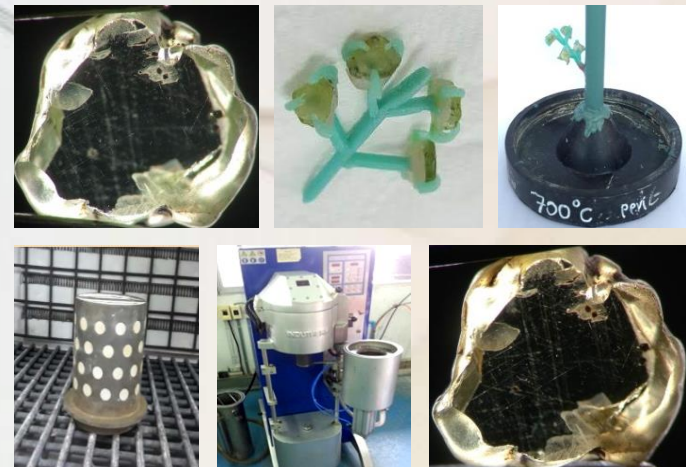


Papichaya Phubangkertphol and Emmiga Jandeng
Asst. Prof. Dr. Nuttapong Pinigkha

MATERIALS

THE SUITABLE TEMPERATURE FOR STONE IN PLACE CASTING USING PERIDOT

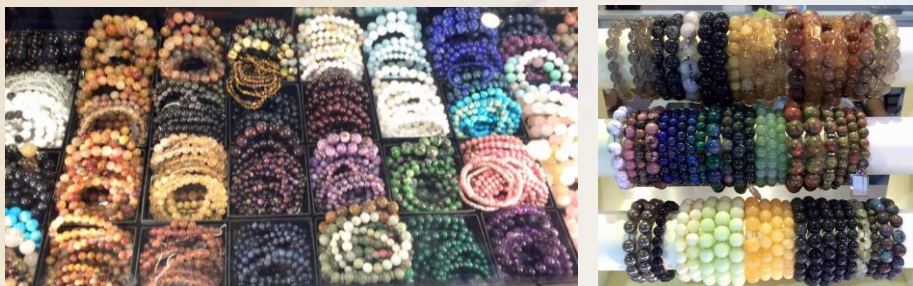
Stone in place casting using semi-precious stone (Peridot) and sterling silver were consider the highest temperature in perforated flask and also their inclusion especially liquid inclusions that damaged stone after casting. The suitable temperature for peridot on stone in place casting process is 600 - 650 °C. Liquid inclusions such as feather, fingerprint were enlarged and obvious after increasing temperature more than 650 °C. The UV-Vis-NIR spectrum showed the absorption of Fe^{2+} at 400, 450, 474, 498 and 636 nm.



Patimaporn Chattranusorn, Thanawaree Lampornsiri and Wirunya Osotnimitdee
Dr. Bongkot Phichaikamjornwut

COLORED STONE BEAD DIVERSITY IN GEMSTONE MARKETS OF BANGKOK

In Bangkok gemstone markets, there are several varieties of colored stone beads such as natural gemstones, artificial gemstones (synthetic and imitation or simulant gemstones) as well as natural simulants. All of them are confusing to the buyers and the sellers. Five selected websites were investigated, for the species and varieties of the colored stone beads before collecting the samples from 30 shops in Bangkok at: Platinum Fashion Mall, Palladium World Shopping Mall, Sampeng-Yaowarat Market, Chatuchak Weekend Market and Jewelry Trade Center. Totally 138 samples (3 beads for each, 34 species, 116 varieties) were found. The samples were identified based on mineralogy and gemological techniques. There are 68 natural gemstones (inorganics = 65 var. and organics = 3 var.), 70 artificial gemstones (simulants = 68 var.) Within this, there are some treated samples (e.g., dyed tiger's eyes, coated glasses). There are several trade name such as Dragon's vein (glass), "Hok-Lok-Xiu" (dyed quartzite).



Thanwarat Yuvanasiri and Chalermchai Jirayuwutti
Assoc. Prof. Dr. Seriwat Saminpanya

A STUDY OF THE PERCEPTION OF THAI FEMALE CUSTOMERS TOWARDS COLOURED CUBIC ZIRCONIA RINGS

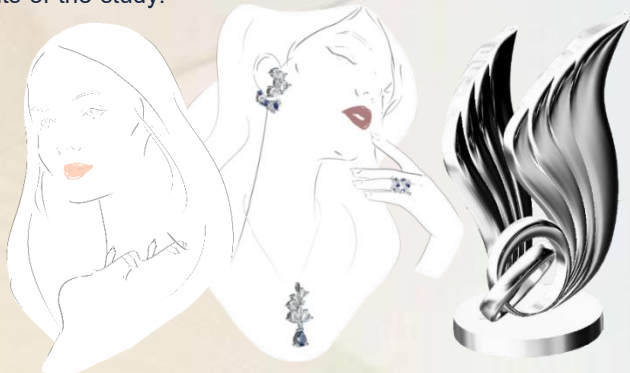
This research aims to study the perception of Thai female customers towards coloured cubic zirconia (CZ) rings. Forty pieces of rings in two designs (solitaire and eternity) and two colours of silver (rhodium plating) and pink gold (pink gold plating) were used in this experiment. Thirty female participants, aged between 25 to 40, were asked to put the ring on their finger and rate the feelings of five pairs of adjectives (gentle-powerful, relaxed-enthusiastic, simple-elegant, creative-logic and humble-confident) on preference scale of 1 to 5 (where 1 represents gentlest, most relaxed, simplest, most creative and humblest and 5 represents most powerful, most enthusiastic, most elegant, most logic and most confident). From the results, it is clear that in both designs and colours of rings, colourless CZ rings were perceived to be elegant and confident, black CZ rings were perceived to be powerful, enthusiastic and confident, and pink CZ rings were perceived to be gentle and relaxed. Also targeting customers felt the green CZ eternity pink gold ring to be stronger than the green CZ eternity silver ring for all pairs of feelings except the pair of humble-confident feelings.



Jirarat Keaitaisong, Namfon Charoensappanich and Prasitya Wannasopa
Supinya Wongsriraksa

A STUDY OF CHINESE TOURISTS' PERCEPTION OF JEWELRY DESIGN

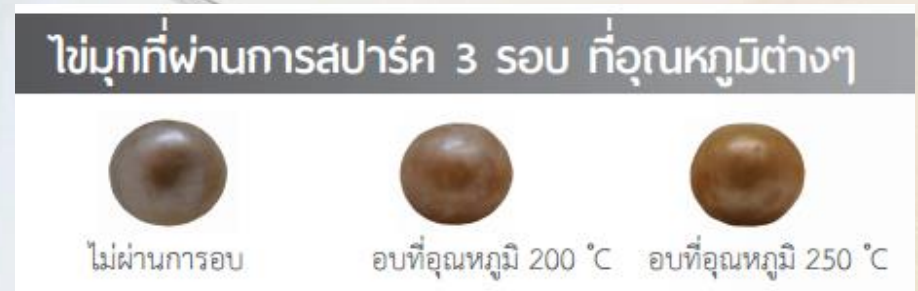
According to a survey data set by Tourism Authority of Thailand (TAT), the highest number of tourist visited Thailand are Chinese people due to their high purchasing power especially on jewelry. This research study aims to provide jewelry designs that respond to the needs and personality of Chinese people. In particular, it consists of two parts: the one focuses on designing fine jewelry for upper-middle-class Chinese people while the other focuses on designing souvenir and fashioned jewelry for the middle-class Chinese tourists. We developed questionnaire assessing their perceptions using the concept of emotional design. The results yield that looking elegant is the most popular perception among upper-middle-class Chinese tourists, while being minimal is the most selected perception among middle-class Chinese visitors. In addition, it is found that Thai culture can be described as prosperous, traditional, and healthy by this middle-class group. Our research concludes with new jewelry designs that motivated by those perceptions as results of the study.



Kirapas Rahothan, Nidnipa Kulnantaweechoat and Pannarai Kornkaew
Asst. Prof. Dr. Kageeporn Wongpredee
Dr. Nattapong Kongprasert and Dr. Porngarm Saengratwatchara

COLOR TREATMENT FOR PEARL BY NANO SILVER PARTICLES

Heat treatment is normally used to enhance the color of natural ambers. Very slightly greenish-yellow ambers from Columbia were used in this studied. The samples were divided in three groups: gY2/4, gY3/1 and gY2/2 according to the GIA Color Master. The samples were cut and polished into squares with 2-mm thickness. The heating experiments were done using an autoclave, hotplate, oil and low-temperature furnace between 120-180°C atmospheric pressure. After the treatment in a low-temperature furnace, the amber samples turned saturated yellow (Y5/5). FTIR spectra did not show any peculiar peaks after the heat treatment.



Anipharunt Koonsawang, Thunyachanok piyanopparat and Tunsita Volrametchaikul
Asst. Prof. Dr. Thanut Jintakosol

DESIGN

A STUDY OF THAI WOMEN'S PERCEPTION TOWARD LOVE SYMBOLS

Currently, many Thai's jewelry brands show high potential to compete internationally, but struggle with finding unique designs that represent their jewelry collections and brands. This research attempts to systematically find ways to provide jewelry designs that respond to one's personality and/or occasion. Especially, we assess women's perception of love in order to create designs of jewelry that truly represent love from their eyes. In doing so, we adopt the seven types of love from Sternberg's theory of love to represent a variety of relationship status. A hundred of Thai women were then asked to identify their current relationship status using those types of love and according to their perception. The results demonstrate that the top three selected love symbols are infinity sign, heart, and diamond. We conclude our research by proposing new jewelry designs inspired from those three symbols.



Thiantip Chuanprapun

Asst. Prof. Dr. Kageeporn Wongpredee

Dr. Nattapong Kongprasert and Dr. Porngarm Saengratwatchara

TOPIC

GEMSTONES

- (1) CRUCIBLE FOR ZIRCON ENHANCEMENT BY MICROWAVE OVEN
- (2) EFFECT OF HEAT TREATMENT AND ION IMPLANTATION ON ZAMBIAN AQUAMARINE
- (3) HEAT TREATMENT OF ZIRCON FROM TANZANIA AND CAMBODIA
- (4) STUDY OF PETRIFIED WOODS OF THAILAND BY SEM AND SYNCHROTRON
- (5) THE COMPARATIVE STUDY OF THE ETHIOPIAN OPAL ENHANCEMENT : SUGAR AND SMOKE TREATMENTS
- (6) THE STUDY OF GEMOLOGICAL PROPERTIES AND CHEMICAL COMPOSITION IN SYNTHETIC BLUE AND GREEN SAPPHIRES
- (7) THE SUITABLE TEMPERATURE FOR STONE IN PLACE CASTING USING GARNET FROM TANZANIA
- (8) X-RAY ABSORPTION SPECTROSCOPY STUDY ON ANCIENT GLASS BEADS
- (9) X-RAY ABSORPTION SPECTROSCOPY (XAS) ON THE ANCIENT TREATMENT CHALCEDONY BEADS EXHUMED FROM THE DVARAVAT

DESIGNS

- (10) GEMSTONE INVENTORY SYSTEM DESIGN FOR JEWELRY CREATING PLANNING
- (11) MECHANISM DEVELOPMENT TO APPLIED IN JEWELRY AND ORNAMENT

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- (12) ADSORPTION OF Ag(I) USING FIBROIN FROM SILK COCOON WASTE**
- (13) A STUDY ON FORMING SILK COCOON BY COMPRESSION MOLDING PROCESS**
- (14) BOROSILICATE OPALINE GLASS COMPOSITIONS**
- (15) COLORS ON PATINA COPPER ALLOYS AND STEEL**
- (16) EFFECT OF SILVER CONTENT TO Ag-Cu-Zn-Sn SOLDER ALLOY**
- (17) FABRICATION OF SILK FIBROIN BY CASTING PROCESS**
- (18) INDUCTION HEATER FOR BRAZING JEWELRY**
- (19) PERFORMANCE OF MANUFACTURING IN CASTING JEWELRY ANALYSIS**
- (20) REDUCTION OF GOLD(I) IN PLATING WASTEWATER USING CHITOSAN-BAMBOO CHARCOAL COMPOSITE ADSORBENTS**
- (21) SILK FABRIC DYEING WITH GEMSTONES**
- (22) THE INNOVATION OF PINK PLATINUM : METAL INTERMETALLIC COMPOUNDS**
- (23) THE STUDY OF THE COATING ON NON-CONDUCTIVE MATERIALS USING ELECTROFORMING.**
- (24) THE STUDY PROPERTIES OF THE OXIDE FILM IN ANODIZED ALUMINIUM BRONZE JEWELLERY**

The aim of this research is to study the coating of non-conductive materials using the electroforming process. Two different conductive paintings (copper bronze and graphite) were applied to the non-conductive samples before electroplating in nickel electrolytic solution with 55-60 °C and 1.5V for 2 hours. It was found that the surface of plated-nickel sample using copper bronze conductive paint is more uniform and thinner than that of the sample using graphite conductive paint as a result of the particle size and the electrical resistance of those two conductive paints.

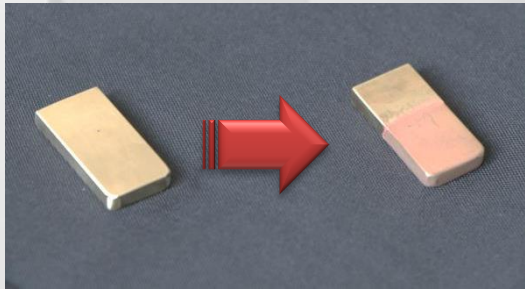
GEMSTONES



Pattiya Srirattanatham and Suprawee Rudsameeprom
Advisor: Supinya Wongsriruksa

THE STUDY PROPERTIES OF THE OXIDE FILM IN ANODIZED ALUMINIUM BRONZE

This research aims to study the properties of the oxide film formed on the anodised aluminium bronze. The aluminium bronze samples were immersed in the electrolytic solution of 15vol.% sulfuric acid in which the voltage of 2.5V was applied for 6, 7, 8, 9 and 10 minutes. After the macro and micro examinations of the surface, it was found that the surface of the sample anodised for 9 minutes has the fine and uniform structure. Moreover, the sample anodised for 8 minutes has the smoothest surface when the surface roughness, Ra of all the samples were measured by the profilometer.



Jessadang Pruksathorn and Sasiphim Somchai
Advisor : Supinya Wongsriruksa

EFFECT OF HEAT TREATMENT AND ION IMPLANTATION ON ZAMBIAN AQUAMARINE

Zambian aquamarine from the gem-bearing pegmatite were used in this study. To enhancement the aquamarine, heat treatment and nitrogen ion implantation can be used to improve the colour from the yellowish green to light blue and greenish yellow.



Three pieces of aquamarine sample from the same rough, aquamarine sample before enhancement (left), implanted with nitrogen ions (middle) and heated at 400°C in the reduction atmosphere. Photo by L. Methawan

Methawam Luangpakdee
Advisor: Dr.Bhuwadol Wantanachaisaeng

Co-advisor: Asst.Prof.Dr.Walaikorn Nitayaphat

SILK FABRIC DYEING WITH GEMSTONES

The surface of silk fabric dyed with gemstone powder, Malachite, Lapis lazuli and Jasper was crushed by the ball mill machine that varies in different time, the ball mill time for 3 hours and 6 hours. The silk fabric was modified by a cationic reagent in order to enable the fiber to be dyed. The effects of particle powders were discussed in the result of colour. The result shows that the colour of silk fabric dyed with gemstone powder was crushed by the ball mill time for 6 hours were darker than 3 hours because the particle powder are smaller. Therefore, can coating on the fiber is better.

ผ้าไหมที่ผ่านการย้อมด้วยอัญมณี ที่ได้จาก การบดด้วยเครื่อง Ball Mill	อัญมณี		
	Malachite	Lapis lazuli	Jasper
3 ชั่วโมง			
6 ชั่วโมง			

Jirassaya Chotiyanon, Sitanan Kaewobchoey
and Hathaiphath Saeleaw
Advisor: Asst.Prof.Dr.Thanut Jintakosol

Co-advisor: Asst.Prof.Dr.Walaikorn Nitayaphat

THE INNOVATION OF PINK PLATINUM : METAL INTERMETALLIC COMPOUNDS

Pink platinum metal is made of 3 kinds of pure metal which are platinum, copper, and aluminium. They are melting and formed by the investment lost wax casting process used in gems and jewelry industry. The metal has inter-metallic character. It is hard and brittle due to the metal flocculation. Colour Measure in CIE-Lab compared with pink gold, used for gems and jewelry is found that alloys of formula A and C are the nearest. Moreover, it is investigated the mechanical properties with a Vicker hardness testing, Scanning Electron microscope(SEM) and X-ray fluorescence spectrometer (XRF).



Vinattha Sukvorakulchai
and Thianratchamon Achirayapha
Advisor: Asst.Prof.Dr.Kageeporn Wongpreedee

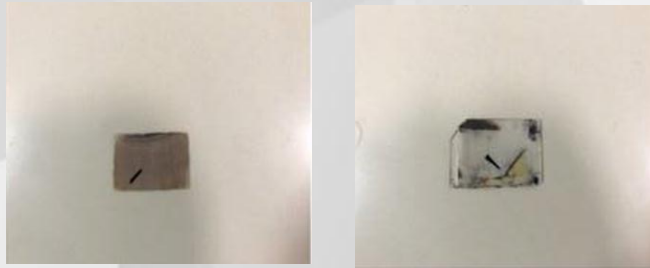
CRUCIBLE FOR ZIRCON ENHANCEMENT BY MICROWAVE OVEN

Zircon that is found in nature is normally reddish brown color. The blue color of zircon is caused by heat enhancement in charcoal or electric oven at around 1000 °C in reduction condition. In this study, crucible for zircon enhancement by microwave oven is successfully used to treat the color of zircon as well as heated by electric furnace. The ceramic power is the raw material to improve the crucible that used in microwave. So, heat-treated by microwave for zircon can be used in color enhancement. The overall result demonstrates for the first time that the effect of materials which has high conductivity in microwave's heating can be reduced time and cost in zircon heat-treatment.



Sasipim Chatnarat
Advisor: Dr.Bhuwadol Wantanachaisaeng

Petrified wood samples from Khon Kaen (BHK-E2), Nakhon Ratchasima (KDH-E1) and Tak (TAK-E1, TAK-3) provinces have been investigated for their chemical composition the use of SEM and synchrotron. The SEM result show that the sample are composed of O and Si for TAK-3 and O, Si, Al, Ca and Fe for KDH-D1. The XRF by synchrotron show that all sample (TAK-E1, BHK-E2 and KDH-E1) contain Ca, Fe, Co, Ni and Zn.



Tikamporn Amsamarng, Ratcha Limthong
and Wanasanan Jatusan
Advisor: Assoc.Prof.Dr.Seriwat Saminpanya

Current jewelry manufacturing is growing and generated revenue for Thailand are enormous. This production requires expertise as well as advanced tools to maximize efficiency. Although production will have modern equipment and better technology. The production process also encountered many problems. The objective of the study were to analysis size of product and type of metal result to defect in casting process and than were to replication issues and factors involved. The experimental casting Thin and thick met Defect 4 types Oxides inclusions, metals grain, Gas porosity, Shrinkage porosity researchers chose Defect found in the work of some of Defect Oxides inclusions and specimen thickness found defect metal grain simulation problem.

Rattanaporn jumpahom and Sineenat sudjan
Advisor: Asst.Prof.Dr.Kageeporn Wongpreedee

REDUCTION OF GOLD(I) IN PLATING WASTEWATER USING CHITOSAN-BAMBOO CHARCOAL

Chitosan-50% bamboo charcoal composite beads were used as Au(I) ion adsorbent. The most suitable condition for plating wastewater adsorption, such as pH value, adsorbent dosage level and contact time were evaluated. The maximum Au(I) ion removal took place at pH value of 4, the adsorbent dosage was 15 g, contact time was found at 180 minutes. Under optimum conditions the maximum removal was 49.63%



Tharungrapat Khunabut and Nawapan Treekuna
Advisor: Asst.Prof.Dr.Thanut Jintakamol

Co-advisor: Asst.Prof.Dr.Walaikorn Nitayaphat

HEAT TREATMENT OF ZIRCON FROM TANZANIA AND CAMBODIA

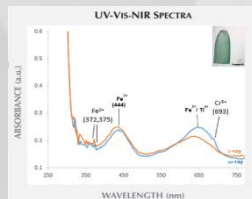
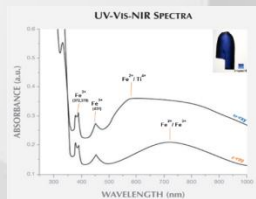
Zircon can be heated from reddish brown color to colorless to blue color depending on the origin. Tanzanian zircon turned color from brownish pink to colorless and Cambodian zircon changed the color from reddish brown to slightly blue, after heating at 400, 800, 1000°C under reduction atmosphere. The FTIR spectra can be used to indicate the unheated zircon by the appearance of couple peaks at 4072 and 4262 cm⁻¹. On the other hand, the unheated Tanzanian zircon has not showed these couple peaks in the absorption spectrum. The UV-vis-NIR spectra showed change of color after heat treatment and showed the decreasing of color absorption band at 400-600 nm by color center.



Walaikorn Siriaucharanon
Advisor: Dr.Bhuwadol Wanthanachaisaen

THE STUDY OF GEMOLOGICAL PROPERTIES AND CHEMICAL COMPOSITION IN SYNTHETIC BLUE AND GREEN SAPPHIRES COMPOSITE ADSORBENTS

Synthetic sapphires especially blue and green colored got higher valued caused by natural stones are rare. Thai and Russia manufacturers using Verneuil process to synthesize blue and green synthetic sapphire which chose for this study. The UV-Vis-NIR spectrophotometer was characterized their absorption spectra. The absorption band of Fe^{3+} was found at 372, 378 and 451 nm and $\text{Fe}^{2+}/\text{Ti}^{4+}$ (IVCT) at 550 and 750 nm in synthetic blue sapphire. In synthetic green sapphire showed the absorption band of Fe^{3+} at 372 and 375 nm, $\text{Fe}^{2+}/\text{Ti}^{4+}$ (IVCT) at 550 and 700 nm and Cr^{3+} at 693 nm. Photoluminescence spectrum showed the absorption band of Cr^{3+} at 693 and 694 nm in all sample.



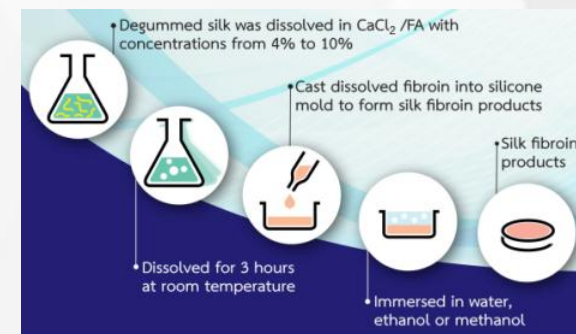
Jaturong Lueangpakorn, Narueporn Srisawasdi
and Araya Jonouchi

Advisor: Dr.Bongkot Phichaikamjornwut,

Co-advisors: Dr.Bhuwadol Wanthanachaisaeng
and Asst.Prof.Dr.Amonmat Kiratisin

FABRICATION OF SILK FIBROIN BY CASTING PROCESS

Silk fibroin is one of the materials found in nature which possess high strength, high tension and good toughness. Because of these excellent properties, and being also non-poisonous for human body and environmentally friendly, silk fibroin can be used as a biomaterial. Interest for silk fibroin is related to various applications: particularly jewelry. In this research, silk fibroin was produced by dissolving dry degummed Bombyx mori silk in Calcium Chloride ($[\text{CaCl}_2]_2$) / Formic acid (FA) solvent. Different concentrations of $[\text{CaCl}_2]_2$ (from 4% to 10%) were used in order to obtain preferred ratio for dissolving fibroin to fibroin solution which is suitable for casting. After that step, methanol was used in post-treatment process. The secondary structure of silk fibroin is obtained by transfer from random coil to crystalline after methanol treatment.



Chalida Wadwong, Tharathip Janhom
and Thitikan Nilkaew

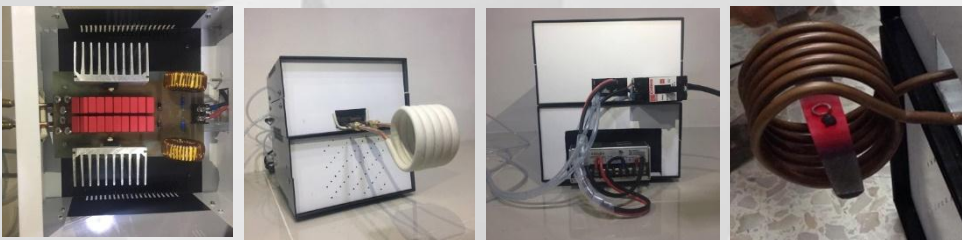
Advisor: Dr.Supitcha Suphansomboon

Co-advisor: Asst.Prof.Dr.Amornrat Promboon

INDUCTION HEATER FOR BRAZING JEWELRY

This research aim to develop the induction heater for brazing jewelry. Induction heater is the process of heating an electrically conduction object by electromagnetic induction, through heat generated inside the object itself. The system is designed by using single phase supply 220V 50Hz converted to DC (direct current) supply and the switching to 24V and inverter circuit transfer to 275V at induction coil.

The experiment revealed the steel is best to induction heating, due to their ferromagnetic nature. The result in a temperature around 600°C with in 1.5 minutes.

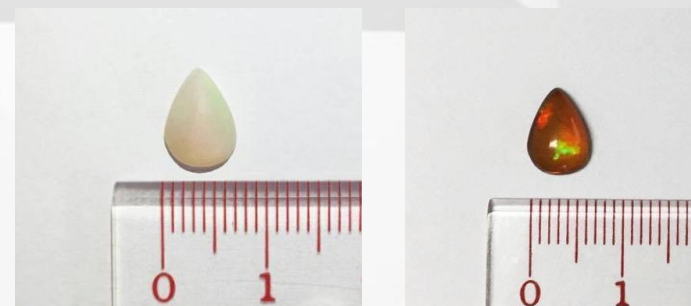


Chanikan Boonsanong, Parintorn Phramsupha
and Rattanarat Srikong
Advisor: Asst.Prof.Dr.Thanut Jintakosol

THE COMPARATIVE STUDY OF THE ETHIOPIAN OPAL ENHANCEMENT : SUGAR AND SMOKE TREATMENTS

Ethiopian opal continues to be one of the most popular gemstone in the world. Most of raw Ethiopian opal is white-pale yellow, and it commonly undergoes a treatment procedure to darken its color, and to bring out their play of color effect.

The main objective of this research is to find the best condition from the two difference treatment methods such as sugar treatment and smoke treatment. Also, to compare characteristics, particularly physical properties and internal features of some Ethiopian opal before and after treatment.

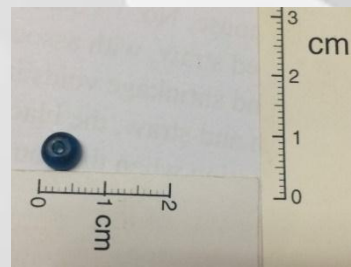
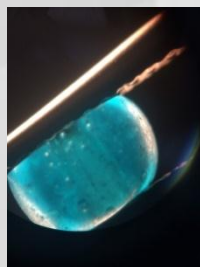
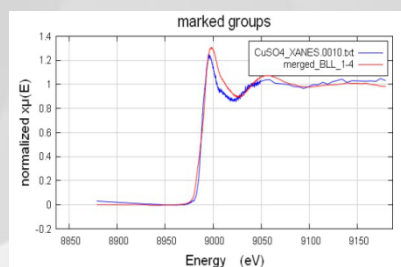


Sirapat Ploypetch and Kritsakorn Polcharoen
Advisor: Dr.Bongkot Phichaikamjornwut

Co-advisor: Dr.Bhuwadol Wanthanachaisaen

X-RAY ABSORPTION SPECTROSCOPY STUDY ON ANCIENT GLASS BEADSGARNET OF TANZANIA

This study focuses on the oxidation states of Cu and Fe in the ancient glasses from Sakaew and Mae Hong Son provinces, Thailand. The experiments have been done by using Synchrotron by means of X-ray fluorescence (XRF) and X-ray Absorption Spectroscopy (XAS). The result shows that the glass samples of blue, green, and aquamarine colors are composed of Cu^{2+} and Fe^{3+} .



Chanakarn Samrong, Nichanan Potisuppaiboon
and Sirilak Footrakul
Advisor: Assoc.Prof.Dr.Seriwat Saminpanya

COLORS ON PATINA COPPER ALLOYS AND STEEL FROM THE DVARAVATI TOMB

Color on metal represents an attractive work, particularly if referred to jewelry items. Patination is one of the simplest techniques for coloring metals. In this research work, colors on artificial patina on copper alloys and steel were studied. There are many factors which affect color consequent to the application of a patina. The type of metal and thickness of the patina film are important factors in this work. Colors on patina copper, brass and steel, in different immersion times, were compared.



Natchanok Mangkang , Punyaporn Siriphurk
and Sirinart Nijvirot
Advisor: Dr.Supitcha Supansomboon

Co-advisor: Asst.Prof.Dr.Anocha Munpakdee

EFFECT OF SILVER CONTENT TO Ag-Cu-Zn-Sn SOLDER ALLOY

In jewelry industry, soldering is a method of joining component to durable jewelry. An alloy called solder that normally is silver solder. This research was studied microstructure and mechanical properties of silver 30%, 40%, 50% and 60% respectively in Ag-Cu-Sn-Zn solder. The solder examined by Micro-vickers hardness. The result Vickers-hardness of silver solder decreased when amount of silver increased. At 60% silver was the nearest color to sterling silver.

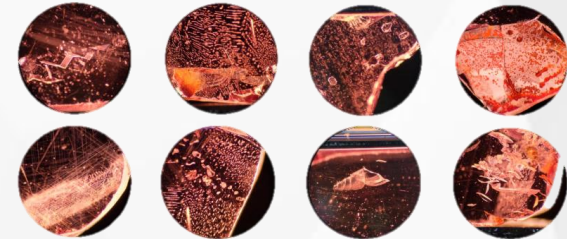


Kittamet Boriboon and Pitchaya Pipakdee
Advisor: Asst.Prof.Dr.Thanut Jintakosol

THE SUITABLE TEMPERATURE FOR STONE IN PLACE CASTING USING GARNET FROM TANZANIA

The aim of this research for developing the stone in place casting process need to be lower costs and decrease time in the process. Stone in place casting using semi-precious stone (Garnet) and sterling silver were consider the highest temperature in perforated flask and also their inclusions especially liquid inclusions that damage stone after casting. The suitable temperature for garnet on stone in place casting process is 650°C. If the temperature increase more than 700°C then inclusion were enlarged. The UV-Vis-NIR Spectra showed the absorption band of Fe²⁺ at 369, 441, 507, 510, 525, 579 nm and Mn²⁺ at 425 nm.

ภาพนี้ภายในหลอดการเกิดตัวว่าง เมื่อตรวจด้วยกล้อง Microscope



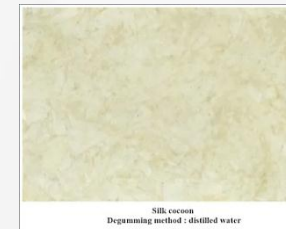
Suphalak Chairit, Suthima Piratamornphun
and Suchada Tanakamonpradit
Advisor: Dr.Bongkot Phichaikamjornwut

Co-advisor: Asst.Prof.Dr.Kageeporn Wongpreedee

DESIGNS

Silk fiber is one of famous natural fibers, because of its excellent properties. Silk fiber and its related products can be used in various applications. In this research, silk cocoon was formed by compression molding process in order to be useful for application in jewelry and for producing decorative items and souvenirs. The optimal condition for compressing silk cocoon was studied. Different degumming processes including distilled water and sodium carbonate were used in order to prepare silk cocoon before compression molding process.

The results showed that for silk cocoons degumming, using distilled water, and compression at 120-130°C for 60-80 minutes are acceptable conditions in order to form the desired shape. The use of for degumming process was able to reduce compression at 100°C for 40 minutes. Furthermore, different degumming processes provided different textures on compressed silk products.



Thidaploy Sondée and Anuthida Lohsuriya
Advisor: Dr. Supitcha Supansomboon

Opaline glass is the blue-tinged semi-opaque or clear glass with milky opalescence in its centre. The opalescent effect is produced by the slower cooling of the molten glass, having high viscosity and causing partly crystallisation inside the glass. (Shown in figure 3.) This kind of glass glows a golden-yellow colour when light shining through from behind it, and a beautiful blue when light shines onto the surface from the front. In this research, the opaline glasses are produced by using Tricalcium phosphate and Sodium pyrophosphate as opacifier. Opacifier-phosphorus was also introduced into the experimental materials at the mixing preparation stage. In term of phosphorus oxide the content of this additive was less than 1-7wt%. Opalescence was observed in the glass already after kilning, and their light transmission depend on the phosphorus oxide content. The Opaline glasses obtained from this method have the specific gravity of 2.44-2.58 and the refractive index of 1.50-1.52.



Keeratipron Yoaharee and Apichaya Teerawatchai
Advisor: Asst.Prof.Dr. Anocha Munpakdee

The study of x-ray absorption spectroscopy (XAS) on the ancient treatment chalcedony beads exhumed from the Dvaravati tomb by the use of synchrotron beamline 1.1 w (Multiple x-ray techniques) consists of two experiments, X-ray fluorescence (XRF) and X-ray absorption near edge structure (XANE). In the XRF results of the ancient samples from Ban Nong Phak Waen and Ban Khok Phlai Taphaya, Sa Kaeo and the natural samples from geological occurrence from Ban Huaydeelert, Chai Badan, Lop Buri province show trace elements, including Ca, Sc, Ti, V, Cr, Mn, Fe, Ni, Cu and Zn. The XANE used to study oxidation states of Cu by comparison with standards of CuO and Cu₂O, was found that all samples have oxidation state of Cu⁰. At this stage, it is known that Cu does not the cause of color of treatment of chalcedony beads exhumed from the Dvaravati tomb.



Phusuda Kingkanlaya, Rattavalee Viriyasansakun
and Patcharin Rakponramuang
Advisor: Assoc.Prof.Dr.Seriwat Saminpanya

MECHANISM DEVELOPMENT TO APPLIED IN JEWELRY AND ORNAMENT

This research was develop the mechanism for jewellery and ornament, and studied the customer's attitudes by using the process of mechanism in jewellery, designing, and producing in order to create a jewellery which is beautiful, worthy, and suitable for wearer's identity. Production team studied six different types of mechanism and design eight pieces of jewellery which totally different are shape, pattern, and usability. The production team also use the questionnaire to studied customer's attitudes. After finish studying customer's attitudes from questionnaire, the production team choose three pieces of jewellery which are most popular to be in the producing process



MATERIALS

Kornkamol Suttasan, Samita thepwimonpetkun
and Watcharapun Siriwachiraworaku
Advisor: Asst.Prof.Dr.Thanut Jintakosol

ADSORPTION OF Ag(I) USING FIBROIN FROM SILK COCOON WASTEEXHUMED FROM THE

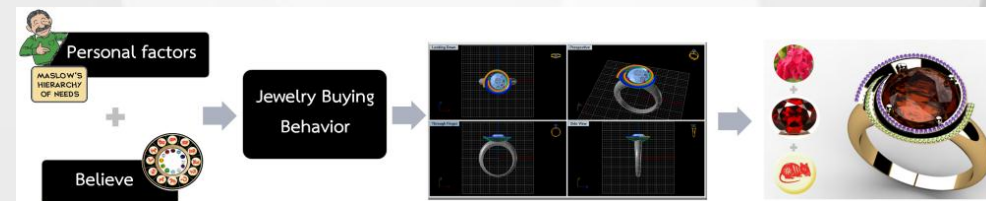
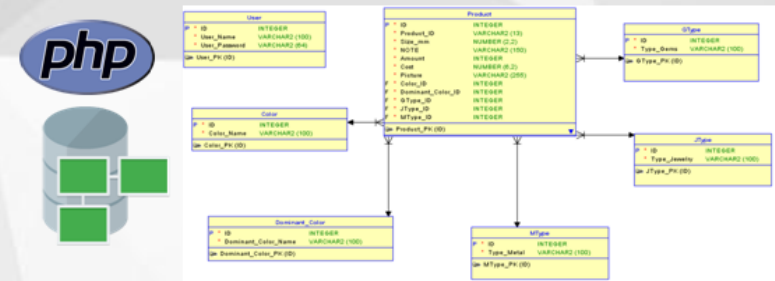
Fibroin beads were used as adsorbents for the removal of silver ion (Ag⁺) from aqueous solution. Equilibrium adsorption was achieved within 90 min. The optimum pH value for Ag⁺ removal was found to be 5. The maximum adsorbent dosage for Ag⁺ removal was 0.01g/L. Under above maximum conditions the Ag⁺ removal was 80.17%. The maximum adsorption capacities of fibroin beads as obtained from Freundlich isotherm were found to be 1.02 mg/g, respectively. The adsorption kinetic agrees well with the pseudo-first order model. The Ag⁺ desorption of fibroin beads was 30.49% at pH=4. The adsorption and desorption experiment demonstrated that the fibroin beads can be used as an effective adsorbents for removal of Ag⁺ from aqueous solution.



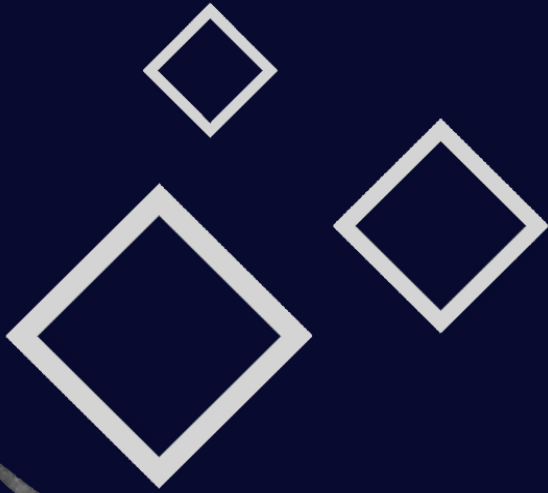
Natpitsara Rattanatangkoon, Ploy Wongjindawest
and Pongtorn Lampasri
Advisor: Asst.Prof.Dr.Thanut Jintakosol
Co-advisor: Asst.Prof.Dr.Walaikorn Nitayaphat

GEMSTONE INVENTORY SYSTEM DESIGN FOR JEWELRY CREATING PLANNING

This research project has been supported by Sapphire Valley Co.,Ltd. Which is one of the Thai Jewelry SMEs. Mostly, this type of business has difficulty in managing for instant gemstone inventory. In this studies, the ABC analysis and the GIA gemstone grading have been used to generate the gemstone inventory code. The PHP software is the most appropriate for the gemstone inventory management. A sample of Jewelry has been designed after the symbols of Chinese Zodiac and Lucky Symbols.



Anyamanee Klaewkla, Metharat Nathong
and Thanachaphorn Petchnoi
Advisor: Asst.Prof.Dr.Amonmat Kiratisin
Co-advisor: Asst.Prof.Dr.Nattapong Kongprasert



GEMS & JEWELRY PROJECT ABSTRACTS



Gems and Jewelry Program

Faculty of Science, Srinakharinwirot University



GEMS & JEWELRY PROJECT ABSTRACTS
of
Senior Students
Gems and Jewelry program,
Faculty of Science,
Srinakharinwirot University

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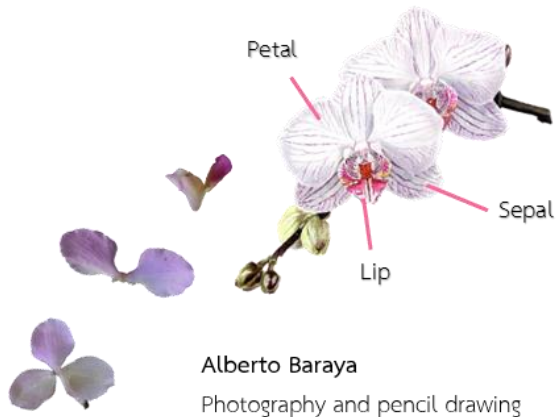
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DELICACY

This research aims to create a model of jewelry that shows the delicacy. The definition of delicacy represents women. The relations of a women and flower are the main concept in design. The orchid inspiration arises from the idea of beauty symbol in women. Moreover, orchid is a symbol of fertility, perfection, delicacy and feeling of the admirable beauty according to Feng shui belief. We, the researchers, have studied all aspects of orchids including drawing with pencils, watercolors, sculpture and photography. The masterpiece of jewelry design is consistent with the art of the artist named Alberto Baraya and apply differentiation strategy as a marketing strategy, which is a model of jewelry that shows the delicacy.



Anyeon Tangkultorn
Advisor Asst.Prof.Dr.Kageeporn Wongpreedee
Co-advisor Christina Riedel

Sponsored by

ORGEMME
Création

AESTHETIC OF PHRAE

Phrae province is a historic city at the confluence of Yom River in Haripunchai kingdom of North Thailand .The city has wealth of historic attraction and variety of cultural .This work aims to create contemporary jewelry, which is inspired Phrae province meaning of their own cultural particularities to be recognized and remembered .Such a famous architecture story of Baan Wong Buri and Khum Chao Luang. Decorated the Teak wood refer to beautifully twist through the perform works of fascinate design jewelry .Especially, this collection chose dark blue sapphire gemstone that the color is represent Mauhom fabric which sourced from Phrae province as well. This work is an exploration of the architecture where beauty always goes well the cultural, beliefs and attitude toward urban life.



Krissada Jaikeaw

Papimol Munchawanont

Advisor Asst.Prof.Dr.Duangkhae Bootkul

REXX

CONTEMPORARY JEWELRY INSPIRED BY DINOSAURS



Rex.jewelry



rexxjewelry



DINOSAURS (Collection : TRICERATOPS)

"165 million years ago, gargantuan prehistoric creatures, Dinosaurs, roamed the Earth. Possessing remarkable anatomical structure which demonstrates their power and strength, the bigger, the more powerful. Therefore, their physical appearance is considered to be "ornamental" showing simultaneously their beauty and strength.

Likewise, comparing to the people of the present of time, they desire accessories in order to fulfill and enhance their needs in terms of beauty, remarkableness and identity."

Pichaporn Limthongpisan, Patticha Inchan and Tatsarat Kaewmanee

Advisor Dr.Bhuwadol Wanthanachaisaeng

THE STUDY OF MODERNIZING NAGA JEWELRY FOR WORKING WOMAN GROUP

Naga jewelry is one of the ancient Thai jewelry. With the form of naga, Thai people believe in its sacred and use as a lucky charm. However, the complex form of naga give a difficulty to wear as an everyday jewelry without old fashion perception. Therefore, this research is aimed to modernize naga jewelry for working woman group (30-40 years old). The study of customer behavior and customer's need have been done by questioning the target group who believe or interest in naga. Then a set of modern naga jewelry has been developed. Marketing survey test show that the target group suggested that we should reduce the Naga's appearance on the jewelry. They also favor the jewelry made from silver which is bright and light decorated with green gemstones. In short, after our designed jewelry was manufactured, it could be wore as same as our initial objective and purpose.



Rungnej Mongkokkeaw,
Teerarat Pongpornchaikit
and Rachat Ploungphet

Advisor Asst.Prof.Dr.Amonmat Kiratisin

PINK PLATINUM JEWELRY DESIGN FOR JAPANESE CONSUMER

The research aims to find the design and the target group of pink platinum jewelry for Japanese market through the marketing research and the basic statistical analysis. Pink platinum innovation is a new option for jewelry manufacturing by which it is an intermetallic compound. Its properties resist scratching, tarnish and corrosion but brittle so the design should take this property into account. Moreover, Japan is the first rank market for platinum jewelry export of Thailand and Japanese people are open mind toward new things. Therefore, Japan becomes a target country for jewelry design in this research. Since Sakura be like as a symbol of Japan country and has long held relation with Japanese culture. Sakura becomes an inspiration for the jewelry design.

The questionnaire of this research obtains data from 100 samples of Japanese people. The results can conclude the Japanese target group for pink platinum jewelry and the design that satisfy the target group and to assure that pink platinum jewelry suit with Japanese market. This will be used for further pink platinum jewelry design development for Japanese market.



Thanaporn Srinet, Nathamon Imjaroon
and Natcha Lakujitpong

Advisor Asst.Prof.Dr.Kageeporn Wongpreedee

Co-advisor Dr.Porngam Saengratwatchara

And Mr.Pasu ROUNGPANYAROJ

BOORANAKARN JANTABOON



Maephra Patisoni Niramom Church is the one Roman Catholic Church which is the historic architecture and a beautiful Gothic Style in Chanthaburi of Thailand. The beauty of the Cathedral of scene is the initial inspiration to create fantastic design Jewelry for bride. There are three romantic sets of them which the crown is applicable as it can be used as a necklace. The other two sets are earrings and ring also all of them be designed on purpose using in daily life. The body is made from Stirring Silver 925 decorated with pink sapphire. All set are unique, intimate and fully remained romantic magical wedding in church for your day.



Nasaryne Chamnanyon
Bongkoch panyalertsuttisri
and Tharawee pulsawat

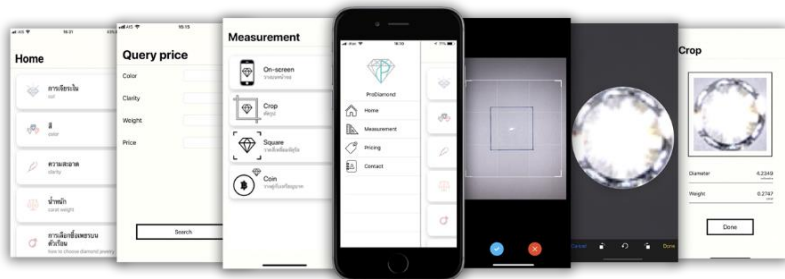
Advisor Asst.Prof.Dr.Duangkhae Bootkul



Production

MULTIMEDIA APPLICATION DEVELOPMENT AIDED DIAMOND GRADING FOR END-CUSTOMER

This research is to develop an iOS mobile operating system application for diamond grading and appraisal which we name it as 'ProDiamond'. This application is suitable for students and end-customers. We have surveyed the users' need for diamond grading and appraisal mobile application. The result shows that the users demand both design and functional. Therefore, 'ProDiamond' has been developed after the result of users' need survey. It contains three features: fundamental knowledge about diamond grading and appraisal which focused on 4Cs, diamond price checking which is informed to the Rapaport price list and diamond size measurement which we have developed four measurement methods. The most reliable methods are crop mode and coin mode which have estimated error at ± 0.01 ct., but coin mode is easier to use.



Nutthanicha Maharoon, Kunyarath Praseeratenang
and Warangkanang Krasaetho

Advisor Asst.Prof.Dr.Amonmat Kiratisin

APPLICATION OF LOW MELTING POINT ALLOY FOR JEWELRY

This research studied the Bismuth-Indium alloys that the eutectic temperature is 70 °c. Also, it suitable for application of low melting point alloy for jewelry that can do it yourself. The user can melt this alloy with hot water and molded into jewelry. Furthermore, we study about the mold design process to this alloy can flow and form easily. The results showed that the alloys have silver color and lustrous suitable for making jewelry. The rubber mold provides the best in molding. The Bismuth-Indium alloys can be re-melted to make a new jewelry again without any discoloration or changed metallic shine.



Pattara Charoenpol , Nopphanat Sae Khow
and Aumpica Kriker

Advisor Asst.Prof.Dr.Thanut Jintakosol

SILK FIBERS DYEING WITH GEMSTONES POWDER

In this research, silk fibers were dyed with 4 types of gemstones powder: malachite, lapis lazuli, jasper, and pearl. The gemstones were crushed into powder by a ball mill machine for 6 hours and then used them as dyestuffs for dyeing the cationic treated silk fibers. The conditions of dyeing were studied. The results showed that the silk fibers were dyeable with gemstones powder. The maximum dyeing efficiency when the pH values of dyebath was 3 for malachite and jasper, and 5 for lapis lazuli and pearl. It is an application to use the idiochromatic gems add value to silk.



Silk Fibers dyeing with gemstones powder

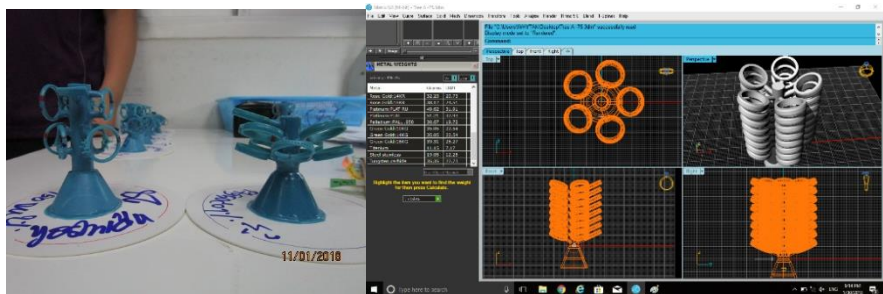
Papatsara Satthaphorn, Chonticha Waenthong
and Wanicha Santeng

Advisor Asst.Prof.Dr.Thanut Jintakosol

Co-advisor Asst.Prof.Dr.Walaikorn Nitayaphat

STUDY THE APPROPRIATE RATIO OF MAIN SPRUE PER PIECE TO REDUCE RAW MATERIAL IN CASTING METHOD

Since I had opportunity to work as a co-operative student in casting department of a jewelry factory, I noticed a problem about inadequate raw materials. Therefore the researcher decide to study about the appropriate ratio of main sprue per piece to minimize raw material in casting method while maintain standard quality. Now This research proceeds in wait result simulation casting. After get result simulation casting and analyst about qualities of casting product for bring the best result simulate to actually casting. After actually casting. Bring casting product investigate qualities to confirm result from simulate. Then summarize result experiment and analyst.



Natnathee Pienngan

Advisor Asst.Prof.Dr.Kageeporn Wongpreedee



Gemstone

BLACK OPAL INNOVATION FROM NATURALS BLACK SPINEL TO GLASS CERAMIC JEWELRY PRODUCT

Natural Black Opal is one of the rarest gemstones on earth due to their dark body tone and the resulting vibrant play of colour. This research aims to imitate Black Opal from natural black spinel from Phrae originated as reinforcement using glass-ceramics sintering method to improve physical and optical properties for jewelry application. The prototype jewelry products are design inspiration from architectural Phrae buildings name Vongbury House. This house combines Thai and Western elements at the end of the nineteenth century. The conceptual innovation product focus on fashion jewelry industry's relationship to functional materials as design inspiration in the creative process and even made profitable.



Waetaga Pantawapirom and Pannarai Puttilarp

Designer Supanida Maneechot

Advisor Asst.Prof.Dr.Duangkhae Bootkul

THE GOLDEN DISPERSION ENHANCEMENT OF NATURAL YELLOW SAPPHIRE BY OXYGEN ION IMPLANTATION BEAM

Oxygen Ion Beam irradiations are able to quality enhancement for natural yellow sapphire. The present study aims to improve the dull yellow sapphire from Vietnam origin, which trace element analysis by using EDXRF (Energy Dispersive X-Ray Fluorescence Spectrometer) show the low of trace element of Ga_2O_3 and Fe_2O_3 to determine cause of yellow color and dispersion. Evidently, optical analysis using microscope the dull yellow became more golden color and luster appearance after using ion implantation technique condition 6 hours /time bombard about 6 times. Also the result of UV-Visible are revealed absorption Fe^{3+} at 350-400 nm.



Thiti Sombatchatakun

Advisor Asst.Prof.Dr.Duangkhae Bootkul

DEVELOPMENT OF A MODEL FOR GEMSTONE HEAT TREATMENT IN MICROWAVE OVEN BY USING DIELECTRIC PROPERTY

A model of gemstone heat treatment in microwave oven has been developed to reduce cost of heat treatment, defined as a common process to improve a quality of gemstones, for local gem burners by using an interaction between dielectric materials and microwave radiation in a microwave oven which can be used to replace electric and gases furnace. The objectives of the study were (1) to examine trend of the relationship between times, temperature, and power (2) to find out the best composition between SiC and heat conductivity then design the crucible which suit for heat treatment in microwave oven. Based on the findings of this investigation it was concluded that temperatures can hit the peak at 840°C for oxidation and 1000°C for reduction. The results obtained from this study can be practically used for burning reddish brown zircons (from Ratanakiri, Cambodia) which changed to sky blue (reduction) and colorless (oxidation) and used for making crucibles for microwave heat treatment.



Panot Krongsut and Teerat Watcharatpong

Advisor Dr.Bhuwadol Wattanachaisang

HEAT TREATMENT OF SEMI-PRECIOUS STONES USING ALCOHOL BURNER AND MICROWAVE OVEN

Zircon, aquamarine, and amethyst were subjected to heat treatment that aimed to enhance the colors of these gemstones. Heat treatment using alcohol burner and microwave oven with specific conditions can be treated to show the changing color of the gemstones. In this research Fourier Transform Infrared spectrometer (FTIR) and UV-Vis-NIR spectrophotometer can be used to determine the treated Preah Vihear zircon.



Siripetch Piriyothaisakul, Patcharaporn Lapnitiporn
and Anyamanee Pisutnoppakun

Advisor Dr.Bhuwadol Wanthanachaisaeng

INDICATION OF HEAT TREATMENT: THE CASE STUDY OF RUBY FROM LONGIDO, TANZANIA

In the past several years, new resources of ruby have been taken in the market, Ruby from Longido, Tanzania often comprise of massive minerals along the surface-reaching fractures, especially diaspore and boehmite, showing as whitish matter. In this study, their gemological data and advanced instrumental analysis were systematically collected for comparison between before and after heat treatment. The samples have been subject to heating experiment with variant temperature in ambient air. After heat treatment, the samples clearly revealed differently overall attribute which was taken place during heat treatment. These results were also here collected by Raman and FTIR spectroscopy as one of the key criterion to determine heat treatment in ruby and sapphire.



Nuttaya Sumritvanicha

Advisor Dr. Bhuwadol Wanthanachaisaeng

COLORED STONE MASTER SET FOR COLORED STONE GRADING AND APPRAISAL

Color is the most important factor in gemstone grading. Due to the wide range of shades of gemstone colors cause difficulty in communication. The objective of this research is to use the color master set as a tool for grading the color of real gemstone color set. It is clearly and easier to visualize. The varieties of natural gemstone sets is based on GIA's colored system, arranged the gemstone in hues, tone and saturation. The results are 8 sets of color stone. Each set were divided into the main hue of the gemstone.



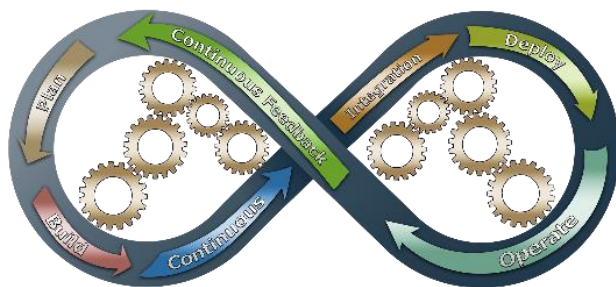
Kornrawee Mansap

and Pennutcha Archeepsamooth

Advisor Dr. Bhuwadol Wanthanachaisaeng

ESTABLISHMENT OF QUALITY STANDARD MODEL PROJECT FOR GEMS IDENTIFICATION LABORATORY ACCORDING TO ISO/IEC 17025 AT GEMS IDENTIFICATION LABORATORIES OF SRINAKHARINWIROT UNIVERSITY

Gems identification laboratories is one of the most significant key factors in the learning and teaching process of Gems and Jewelry Program at Srinakharinwirot University. Therefore, this project aims to initiate the ISO/IEC 17025 to improve the quality standard of Srinakharinwirot University's Gems identification laboratories. The objective is to increase Gems identification analytic efficiency of Gems and Jewelry students based on structure, policy, standards, personnel availability, equipment, and Gems identification laboratory lay out of the organization. In addition, this will also enable the establishing of an accuracy gemological analytic system with verifiable process resulting in shortening of process and time in gems identification process utilizing QM, QP, gems identification work instruction and manual, basic equipment manual, and forms used in scope of gems identification process.

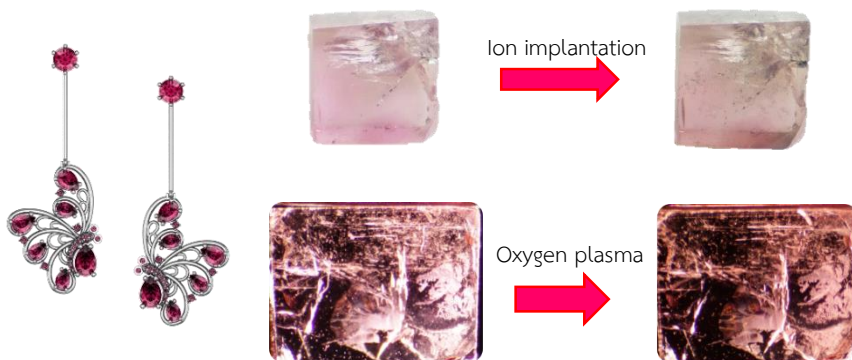


Sirimada Kanmarawanich

Advisor Dr. Bhuwadol Wanthanachaisaeng

ION BEAM TECHNOLOGY AND OXYGEN PLASMA FOR ANALYSIS OF PINK TOURMALINE

Oxygen ion implantation and oxygen plasma annealing are new technique for gemstone enhancement. Pink tourmaline samples from Nigeria were used in this study. The stones turned saturated in pink colored after treated. Liquid inclusions, liquid thin film and minute particle were decreased after using oxygen plasma annealing for 12 hours. FTIR spectrometer detected the hydroxyl group at $3400^{\circ} 3700 \text{ cm}^{-1}$ (OH-stretching) and 5200 cm^{-1} (H_2O) whose intensities decreased after the enhancement. UV-Vis-NIR spectra showed the absorption of Mn^{3+} at 450 and 520 nm and Fe^{3+} at 380 nm that confirmed the causes of color in pink tourmaline. The chemical analysis using EPMA could be calculate pink tourmaline samples formula: $(\text{Na,Ca})_{0.88-1.33}(\text{Mg,Li,Al,Fe}^{2+})_{1.74-1.85}\text{Al}_6(\text{BO}_3)_3^{2.85-2.91}\text{Si}_{6.09-6.20}\text{O}_{18}(\text{OH})_4$.



Panisa Kantaward, Panisara Kantaward
and Pattranid Poonkaseam

Advisor Dr.Bongkot Phichaikamjornwut

THE STUDY OF GREEN TOURMALINE FROM NIGERIA ENHANCEMENT USING OXYGEN PLASMA ANNEALING AND OXYGEN ION IMPLANTATION

Oxygen ion implantation and oxygen plasma annealing are new technique for gemstone enhancement. Three groups of green tourmalines from Nigeria; Dark Green, Green and slightly Green color were used in this experiment. The stones turned saturated in pink colored after treated. Liquid inclusions, liquid thin film and minute particle were decreased after using oxygen plasma annealing for 12 hours. The stones were saturated in green color after oxygen ion implantation 16 hours. FTIR spectrometer detected the hydroxyl group at $3400^{\circ} 3700 \text{ cm}^{-1}$ (OH-stretching), Fe-OH at $4100\text{-}4300 \text{ cm}^{-1}$ and 5200 cm^{-1} (H_2O) whose intensities decreased after treated. UV-Vis-NIR spectra showed the absorption of Fe^{3+} at 380 nm and Fe^{2+} at 720 nm. The chemical analysis using EPMA could be calculate green tourmaline samples formula: $(\text{Na}_{0.70\text{-}0.79} \text{Ca}_{0.10\text{-}0.34}) (\text{Mg}_{0.01\text{-}0.02} \text{Fe}^{2+}_{0.35\text{-}0.39} \text{Mn}_{0.14\text{-}0.17} \text{Al}_{1.70\text{-}1.77}) \text{Al}_6 (\text{BO}_3)_3 \text{Si}_{5.89\text{-}5.98} (\text{OH})_4$.

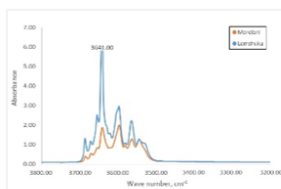


Pichayaporn Nakmeepit, Chatmeena Laowor
and NapathonTungkunaporn

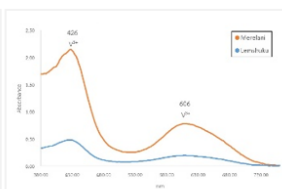
Advisor Dr.Bongkot Phichaikamjornwut
and Asst.Prof.Dr.Duangkhae Bootkul

THE STUDY OF TSAVORITE FROM TANZANIA

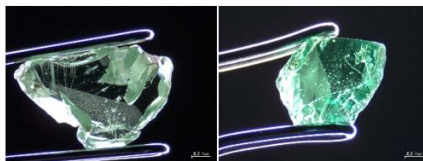
Tsavorite occurrences in Tanzania, Merelani and Lemshuku, were derived from metamorphic origin. The study showed the same gemological properties except their inclusions which is Lemshuku tsavorite had less inclusions than Merelani tsavorite. Raman spectrometer confirmed that crystals in both origins were quartz, apatite, anatase and graphite. FTIR spectrometer detected the hydroxyl group at 3400° 3700 cm^{-1} (OH-stretching) and 5200 cm^{-1} (H_2O). UV-Vis-NIR spectra showed the absorption of V^{3+} at 426 and 606 nm that confirmed the causes of color in tsavorite. The chemical analysis using EPMA showed the amount of V^{3+} in Merelani tsavorite was 0.16-0.17 wt%oxide and Lemshuku tsavorite was 0.02-0.07 wt%oxide. The Merelani tsavorite chemical composition: $(\text{Ca}_{5.77-5.84}\text{Mg}_{0.07-0.10}\text{Mn}_{0.11}\text{Fe}^{2+}_{0.02-0.05})_{6.03-6.04}(\text{Al}_{3.54-3.61}\text{Ti}_{0.04}\text{V}_{0.16-0.17})_{3.75-3.82}\text{Si}_{6.16-6.18}\text{O}_{24}$ and Lemshuku tsavorite: $(\text{Ca}_{5.74-5.92}\text{Mg}_{0.07-0.13}\text{Mn}_{0.03-0.16}\text{Fe}^{2+}_{0.00-0.07})_{6.03-6.11}(\text{Al}_{3.54-3.61}\text{Ti}_{0.03-0.05}\text{V}_{0.02-0.07})_{3.83-3.94}\text{Si}_{6.00-6.13}\text{O}_{24}$.



Peak OH- from FTIR



Vanadium peak from UV-VIS-NIR



Garnet from Lemshuku

Garnet from Merelani

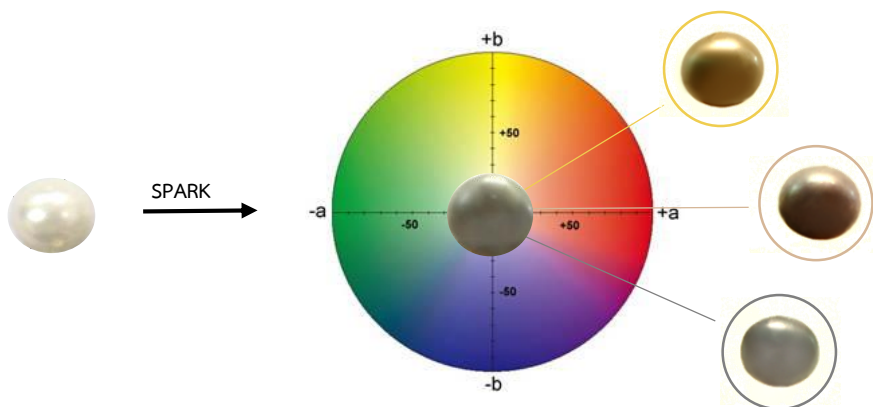
Kanittha Mongkhonsawat

and Phentana Lertkai

Advisor Dr.Bongkot Phichaikamjornwut

COLOR TREATMENT FOR PEARL BY NANO GOLD PARTICLES

Gold nanoparticles are able to enhance the color of freshwater cultured pearls to other colors by using the sparking method. Gold nanoparticles spark to a pearl by using gold and silver wires of 0.325 mm , 0.03 mm , 0.028 mm and 0.260 mm . The duration of the sparks was 30 minutes , 60 minutes and 120 minutes. According to the results , the gold nanoparticle sparked by the gold wire of 0.026 mm for 60 minutes and 120 minutes shows the most hue reddish gray color. This can be concluded that the difference of the gold wire size and the duration of sparking caused the change of the pearl's color from the white one to the different one such as gray color , gold color and bluish gray color.



Pattarasuda Pansurin , Ploy Wattanakitsakul
and Pakjira Sombutsataporn
Advisor Asst.Prof.Dr. Thanut Jintakosol



Business

THE STUDY OF “STARTUP” JEWELRY BUSINESS OPERATION

The objective of this research was to study the guidelines to operate fashion jewelry start-ups for successful business. The research was conducted by collecting data on business operation of start-ups, marketing management, and consumers' demand for jewelry products through the questionnaire. Data obtained were then used for product analysis and marketing management for differentiation and trial in business operation. The results showed that "FAVO JEWELRY", a simulated start-up aimed to present new style of jewelry products of which shape and function are changeable to meet the consumers' daily demand. Magnetic capability was applied as the component under the "COSMOS" collection. The products would be distributed via Internet or e-commerce based on B2C model. The initial findings could be applied for operating the real business and developing the appropriate business practices.



Apinya Mahalabkorkiat
and Petchaphat Saengbunthammaphat
Advisor Asst.Prof.Dr.Amonmat Kiratisin

A STUDY OF RELATIONSHIP LEVEL THAT AFFECT TO PATTERN AND MATERIAL OF COUPLE RING

Since ancient civilizations, Gems and Jewelry have represented love. This can clearly be seen from the use of engagement rings and the exchange of rings during wedding ceremony. At present, Western influence opens up more space for people to express their romantic loves, gender identity as well as ring giving and exchanging to represent their levels of love. This increase in consumption of rings creates the opportunity for expansion or formation of a new consumer segment and marketing channels for gems and jewelry business. The researchers see the benefits of market research through collecting data on factors affecting consumption of rings.

This research therefore aims to 1) study designs and materials for couple rings, and 2) study the factors affecting consumer selection of couple rings. The hypothesis is genders and levels of relationship affect consumer selection of couple rings. The research divides levels of relationship according to the theory of relationship levels and uses relationship assessment scale: couples satisfaction index scales (CSI) in an online questionnaire to collect data from 100 samples. Research results show the designs and materials that are popular among the couples and how levels of relationship affect the selection of couple rings. The approach for design development and expansion of consumer segment are also discussed.



Thunyathon sukkasem
and Yanaphan Thasangkha

Advisor Asst.Prof.Dr.Kageeporn Wongpreedee

Co-advisor Dr.Porngarm Saengratwatchara

FACTORS AFFECTING THE DECISION PROCESS TO BUY JEWELRY VIA E-AUCTION

The research in the title of, "Factors that have effects on the purchasing process of decorations by the auction via the online media", has the objective to study factors that have an effect on the behavior of the auction by making the use of the online media. According to this research, a sample of 300 consumers who have used the auction service of various product via online media has been taken.

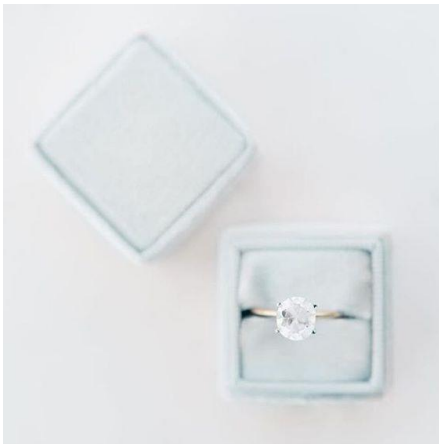
Questionnaires is the main tool used in gathering of the information in order to analyze the information by adopting descriptive statistic. Under the descriptive statistic approach, the frequency, the percentage, the mean, the standard deviation and the T-test statistic have been clearly conducted and represented. The result found that most of respondents are females whose age lies between 18 - 22 years. The main source of auction process for various products was via Facebook website. The majority of the product category that was auctioned online is the silver jewelry.



Kanyarat kittlerdphaisan
and Chanikarn samanyaporn
Advisor Asst.Prof.Dr.Amonmat Kiratisin

A STUDY OF MIDDLE CLASS THAI CUSTOMERS' PERCEPTION TOWARD WEDDING RINGS

This research focuses on the perception of Thai middle class (Salary in the range of 50,000 -75,000 baht) about the wedding relating to their lifestyle. The questionnaire used in this work has been designed to screen the lifestyles of the target group and to match the lifestyles with the love concept and the diamond and wedding ring design which chosen by the target group. The result shows that among 5 lifestyles Casual, Luxury and Sport girl are the most popular and among 10 love concepts Forever, Cherish and Romantic are the most popular. The chosen love is attuned to Solitaire wedding ring and Italian style.



Sophana Chonsiri

Advisor Asst.Prof.Dr.Amonmat Kiratisin
and Asst.Prof.Dr.Nattapong Kongprasert

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