The 14th Santa Fe Symposium on Jewellery Manufacturing Technology

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The 14th Annual Santa Fe Symposium on Jewellery Manufacturing Technology was held at Albuquerque, New Mexico, USA on 21-24 May 2000. Even after 14 years, the Symposium continues to grow in stature with an increasing number of attendees. This year, there were 188 in total and these included 41 from countries outside the USA. As is usual, the first session was an **Introduction to Metallurgy** by the author given as a refresher course and also to familiarise attendees with the underlying principles of many of the topics being discussed later in the Symposium. This was followed by twenty-one papers covering a variety of subjects related to jewellery production.

"Mechanical Properties and Jewellery"
Dr John C. Wright, Consultant to Johnson Matthey, Birmingham Assay Office, Platinum Guild International and the World Gold Council, UK.
The first part of the presentation reviewed typical test methods and the significance of the mechanical property data obtained from the tests. Hardness tests include the scratch hardness test, widely used in mineralogy and gemology, and the resistance to penetration tests, i.e., the Vickers (pyramidal diamond) and the Brinell tests. The following material properties can be measured by the tensile test, namely, the Modulus of Elasticity (E), the Yield Stress (0.2% proof stress), the Tensile Strength (TS or UTS) and the ductility, expressed as either the %Reduction in Area at the fracture or %Elongation to Failure of the original gauge length. Much can be deduced from the shape and details of the stress-strain curve. Ductility tests, such as the Erichsen Test and cup drawing tests give an indication of sheet metal formability and any anisotropy effects.

The second part of the paper was concerned with the elastic properties and their importance in jewellery manufacture and design. In particular, the bending of claws (prongs) when setting gemstones and the control of springback was dealt with in some detail. Another example was the elastic distortion of rings and how the section size and shape influence the load-bearing ability. The third part discussed the plastic deformation properties as the applied stress increases from the yield stress to the tensile strength because this gives an indication as to how the material work hardens.

Finally, some typical failures in shear or tension in jewellery items and complex working and inter-stage annealing operations were described. Many problems could be overcome by a better choice of design, with regard to size and shape, and production sequence. Simple mechanical property tests should be part of quality control.

"Quality Assurance Management in Jewellery Manufacture"
Dr John C. Wright, Consultant, UK.
The first aim of the paper was to describe the general concept of quality and to show how this has changed with time. Hallmarking was introduced in England to regulate the standards of purity for gold and silver wares. During the 19th Century, Michael Faraday reported on the wear of British gold and silver coin and related this to the economics of quality. Nowadays, quality management is seen as a way to counter waste, gain a competitive edge and promote accountability. Various approaches to quality management were outlined and viable quality systems were described. These require inputs of information, e.g. materials properties and their assessment, relevant standards, customer needs, etc. Outputs are also mainly information such as revised standards, process manuals, training and feedback. Environmental influences, e.g. the nickel allergy problem, impinge on the quality system. A sense of priorities whereby influences can be rated in terms of their relative importance can be incorporated using sensitivity analysis. The paper goes on to discuss a Total Quality Management approach and to look at ways in which it might be implemented in the jewellery industry.

"Silicon Microsegregation in Carat Gold Jewellery Alloys"
John McCloskey, Executive Director of Metals, Stuller Settings, Inc., USA.
Silicon is added to carat gold alloys primarily as a deoxidiser although it also increases fluidity during casting. Unfortunately, it has two major drawbacks. First, it promotes large grain sizes in castings and, secondly, it can cause embrittlement when it exceeds a certain critical level. Results from previous investigations suggest that silicon is severely segregated in carat golds (see Normandeau, *Gold Technology* No.15 and Grice, 13th Santa Fe Review, *Gold Technology* No.26.).

This study evaluated the microsegregation of silicon during freezing in Au-Ag-Cu-Zn alloys. Pure copper can dissolve up to 5.25 wt% silicon in the solid state but silicon is virtually insoluble in gold, silver and zinc. Using a Au-Ag-Cu-Zn-Si alloy model, the phase diagram was modified giving an estimated maximum solid solubility of silicon at 852°C of 0.128 wt%. An ideal non-equilibrium solidification model was then used to estimate microsegregation of silicon. The model, described by the Scheil Equation predicts the build-up of silicon in the liquid phase and the subsequent formation of silicon-rich phases in the solidified microstructure. There are dramatic increases in the amount of segregation when the fraction of solid exceeds 0.9. Experimental trials were made on a directionally solidified 14 ct yellow gold silicon-deoxidised casting alloy. Quantitative electron microscopy and other techniques were used to measure the microsegregation of all the elements present in the alloy. This work supported the predicted estimate of the solid solubility of silicon in the 14 ct gold at about 0.1 wt%.

Because the work showed that unexpected silicon-rich phases and compounds appear in the microstructure resulting from non-equilibrium solidification, it was expected that this would have a deleterious effect on mechanical properties. Tests showed that the tensile strength and ductility of the as-cast silicon-deoxidised 14 ct alloy were considerably inferior to those of a silicon-free, grain-refined 14 ct yellow gold casting alloy. Furthermore, the alloy containing silicon exhibited gross orange peel on deformation.

The author is to be congratulated on a very elegant piece of theoretical and experimental work. However, this reviewer was left with the strong feeling that silicon should be avoided as a deoxidant because the disadvantages far outweigh the benefits. *Editor's Note: A version of this paper, focused on the practical aspects, is published in this issue.*

"High-Carat Golds Do Not Tarnish?"

Dr Christopher Corti, Manager, International Technology, World Gold Council, UK.

It is generally thought that tarnishing of gold alloys is confined to the low-carat golds and that high-carat golds will not tarnish. However, there have been many complaints in India that 22 ct gold jewellery goes black during normal wear by the consumer and even goes to a darker reddish shade when displayed in shop windows. After reviewing the current knowledge on the causes of tarnishing in gold jewellery alloys, Dr Corti described the examination of two pieces of blackened 22 ct gold jewellery (Figure 1). Observations made by the donor of the pieces were that the problem mainly seems to occur with gem-studded jewellery, the blackening occurs after a certain time has elapsed, and that many jewellers believe that the source of the problem lies in the polishing procedure. A typical polishing procedure consists in electropolishing in an aqueous solution containing cyanide, a wax and a resin.

XPS spectroscopy and X-ray energy dispersive analytical techniques were used to examine the surface blackening. The results indicated that the tarnish was based on silver sulphide, possibly in the form of more complex oxy-sulphides. Other metals were also associated with the tarnish areas but their origin is not clear. These were not present on the non-tarnished areas suggesting their source was the same as that of the sulphur or from impure water used in pickling solutions. Possible causes of tarnishing were discussed but the question remained as to how it occurred on 22 ct gold. The suspicion that it might indicate undercarating was ruled out as was the use of a low-carat solder since one of the pieces assayed at close to 22 ct and it was not obviously soldered apart from an end fitting. A probable factor was that gold was preferentially removed in the electropolishing treatment leaving a copper-silver enriched surface. It has been reported that gold dissolves faster in cyanide solutions than silver. It is possible also that the wax/resin leaves a surface film, which may contain sulphur. It is proposed that alternative finishing procedures coupled with electroplating a thin flash of pure gold may alleviate the problem. Finally, Dr Corti speculated on possible causes of the reddening of 22 ct jewellery on display but no samples have been available for analysis.

Figure 1

"I'm Dreaming of a White Gold Christmas Bonus"

Stewart Grice, Metallurgical Manager, Cookson Precious Metals Ltd., and Christopher Cart, Technical Director, Weston Beamor Ltd., Birmingham, UK

Stewart Grice began by outlining the background to the use of white gold alloys with particular emphasis on whiteness, colour measurement, the choice of nickel or palladium as the whitening agent and the recent legislation with regard to the nickel allergy problem. He then went on to describe the development of an 18 ct white gold investment casting alloy. The specification requirements were that:

- the alloy must not contain nickel and it must be sufficiently white to avoid the need for rhodium plating,
- it must be possible to enamel the alloy,
- it must have a low liquidus temperature (< 1200°C) so that gypsum-bonded investment can be used,
- it must have a solidification range which encourages form filling,
- and, it must have mechanical and physical properties typical of a general-purpose casting alloy.

An existing wrought Au-Cu-Pd alloy was modified to suit investment casting and trials done with centrifugal and vacuum centrifugal casting machines using graphite crucibles and sulphate (gypsum)-bonded investment. This alloy had a liquidus of ~1190°C with the required mechanical properties. However, perfect form filling was not achieved in all cases and the grain size was very large. These problems were resolved by further modifications including grain refining. This alloy is in current use for castings but further developments on a zinc-free alloy are planned as experience has shown some problems with dross formation on top of the melt resulting in a reduced crucible life. (Figures 2 - 4)

Christopher Cart described the implementation of the alloy into the production of castings. Initially, a horizontal multi-vac casting machine was used but recast rates were high because of non-fills and surface texture problems. A vertical flask rotation high-temperature casting machine was installed giving an immediate reduction in recast rates. It was found also that the introduction of a helical tree sprue as a replacement to the more conventional cylindrical central sprue vastly improved filling as it acted as an impeller forcing metal into the mould cavities (Figures 5 and 6). The cost increase due to the palladium content has been accepted because

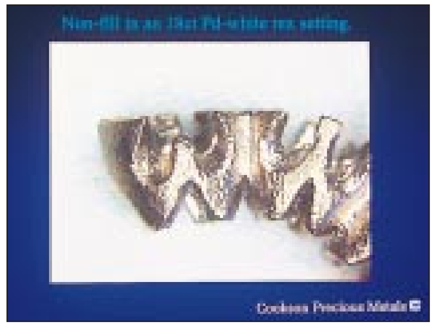
Figure 2

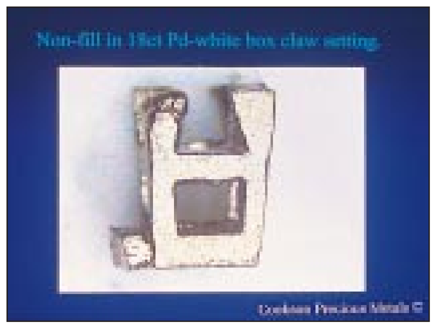

Figure 3

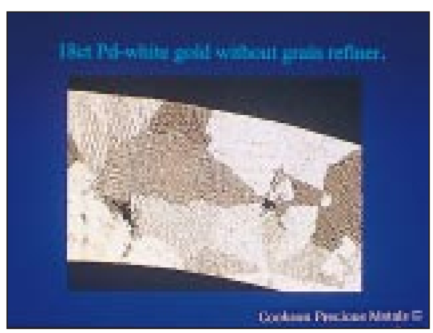

Figure 4

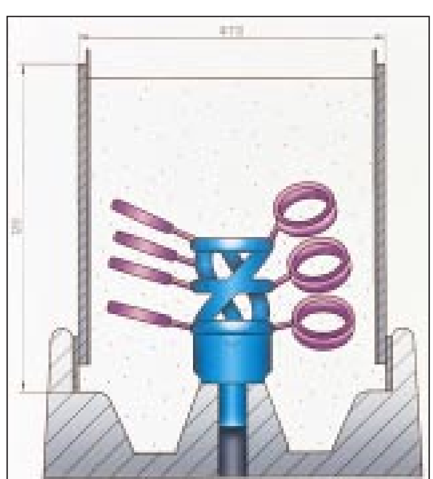
Figure 5

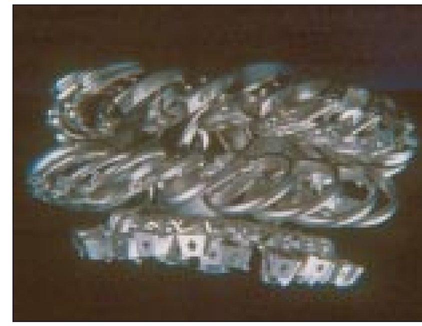
Figure 6

Figure 7

the benefits of colour, lustre, ease of soldering, welding, polishing and gem setting have been recognised by the customers (Figure 7).

"On Nickel White Gold Alloys: Problems and Possibilities"

Dr Valerio Faccenda, Consultant, and Pietro Oriani, Pomellato, Italy.

After a brief review of white carat gold alloys, Dr Faccenda stated that there were two important developments. First, there is a confirmed trend towards a growth in the use of white gold, and secondly, the European Directive that drastically reduces the use of nickel in jewellery production because of the allergy problem. There are five classes of white golds, namely,

1) alloys with controlled nickel content,
2) palladium-nickel alloys,
3) nickel-free, palladium alloys,
4) nickel-free and palladium-free alloys,
5) palladium-platinum alloys.

The primary and secondary requirements for a white gold alloy were discussed, e.g. colour and reflectivity, absence of allergic reactions, mechanical properties, liquidus preferably <1200°C, solderability, resistance to fire cracking, and cost and ease of recycling. Each class of alloy was considered with these requirements in mind. In particular, a comprehensive list of 18 and 14 ct white gold alloy compositions were given together with mechanical property and colour measurement (CIELAB system) data, where available. The artificial sweat test in which the rate of nickel release is measured was described. This must not exceed 0.5 $mg/cm^2/week$. However, there is evidence to show that even a 'safe' nickel-white gold may give an allergic reaction if the consumer has already been sensitised to nickel and the speaker emphasised that caution should be exercised in the use of nickel-containing alloys.

Some producers are offering alloys with grain refining and age-hardening additions. These give improved mechanical properties, castability and finishing characteristics. In conclusion, the criteria to be considered in alloy selection were discussed. Producers should strive to develop new alloys that can be used without rhodium plating. However, suitable solder or brazing alloys that enable jewellers to obtain unnoticeable joints will have to be developed as such alloys are scarcely available.

"Metallurgical and Chemical Factors Influencing Working Conditions"

Dieter Ott, The Research Institute for Precious Metals (FEM), Schwäbisch Gmünd, Germany.

This was a wide-ranging discussion of many of the factors, which influence working conditions in jewellery fabrication. Three main types of jewellery alloys were examined - silver, gold and platinum-based alloys. Melting, casting, annealing and age hardening are all influenced by factors such as melting range, melt temperature, homogenisation, evaporation, crucible type, atmosphere, impurities and deoxidation.

As examples, the evaporation of zinc from carat gold alloys during melting and how it may be reduced was explained; the advantages and disadvantages of oxidising, neutral and reducing atmospheres were discussed; problems associated with the high solubility of oxygen in silver and silver alloys and the reaction of oxygen with copper were described.

It is impossible to deal with all the aspects covered by the speaker in this short review. There is a wealth of practical information, which all jewellery manufacturers could read with advantage as it may assist them in reducing reject rates during production.

"Effects of Water Quality and Temperature on Investment Casting Powders"

Ralph Carter, Materials Engineer, Ransom & Randolph, USA.

It is well known that the quality of lost wax investment castings is dependent on a very large number of factors. Not least, are those that influence the investing process. The investment powder manufacturers ensure that the properties of the investment are reproducible and are of the desired quality. However, there are two factors that are outside their control, namely, the temperature and the quality of the water mixed with the investment. It is generally recommended that de-ionised water is used and that the water temperature is 21-24°C. This study explored the dependency of both gypsum- and phosphate-bonded investments on these two factors.

Three properties of each type of investment were investigated using water from various sources and temperatures in the range 65-85°F (18.3-29.4°C) at 5°F intervals. These properties were pour time, set time and slump. The pour time essentially is the time taken until the investment becomes so thick that it will not pour. The set time is a measure of the time taken for the investment to reach a defined hardness. Slump is a measure of the fluidity of the mixed investment exactly two minutes after the investment has been mixed. Each test method is described in the paper. Water samples from seven sources in Ohio, one from Los Angeles and three from the UK. were used in the study and compared with a standard de-ionised water. The water source tests were done at constant temperature and mix time.

There was a considerable variation in each of the properties with the water from different sources although some were better than others. When these water samples were de-ionised, the variations compared with the standard were very small or zero. This suggests that unless the water is de-ionised it can introduce significant and unwanted process variables. The variations were greater for the gypsum-bonded investment than for the phosphate-bonded investment but de-ionised water should be used for both. The pH, conductivity and total dissolved solids for each water sample were measured. Four samples were sent for extensive analysis. Some observations were made on the possible roles of some of the contaminants but since these can be removed with advantage by de-ionising they are of academic interest.

The effect of water temperature was assessed using the standard de-ionised water. As expected, the pour time and set time were both reduced with increasing water temperature but the slump was not greatly affected probably due to the fact that this is measured well before the reactions come to completion. Process variability is eliminated if the water and the investment are kept at constant temperature although the temperature may be altered to suit a particular application.

"Thermochemical and Microstructural Study of $CaSO_4$ Bonded Investment as a Function of the Burnout Process Parameters"

G.M. Ingo, C. Riccucci, G. Chiozzini and C. Veroli. Presented by Dr G. Ingo, National Research Council of Institute of Materials Chemistry and Professor of Archaeometry, University of Bologna, Italy.

Many past studies have shown that the origin of gas porosity in investment castings is related to the decomposition of $CaSO_4$, which constitutes, with silica, the gypsum-bonded investment. Thermal decomposition of the calcium sulphate is generated by the rapid heating when molten gold alloy is poured into the mould and its extent is related to the casting atmosphere and the detrimental presence of several oxides. This study focused on the effect of temperature and duration of the burnout process on the thermal properties of the investment.

The thermal decomposition was measured using differential thermal analysis (DTA) and thermo-gravimetric analysis (TG) on six commercially obtained investment powders. This was done for both the 'as-received' powder and after the recommended burnout procedures. It was confirmed that the burnout cycle affects the temperature of thermal decomposition. One of the powders was then chosen for further study. The DTA-TG data showed the chemical and physical changes undergone by the investment throughout the burnout cycle. This was backed up by X-ray diffraction and scanning electron microscopy. The results showed that the best burnout cycle temperature, in terms of keeping the thermal decomposition at a high temperature, is 600°C although most investment producers recommend 700-730°C in order to completely remove the wax residues. This work showed also that the wax could be completely eliminated as low as 500°C. In addition, the decomposition temperature is further raised when flowing air combined with dry dewaxing are used, whereas the worst condition is a burnout above 700°C in an inert atmosphere. However, this reviewer believes that there may be other advantages in steam dewaxing which will outweigh the extra gain in decomposition temperature.

"Basic Ceramic Considerations for the Lost Wax Processing of High Melting Alloys"

Dr Helmut Frye, M. Yasrebit and D.H. Sturgis, Techform Advanced Casting Technology LLC, USA.

The aim of this paper was to present a methodology for the design of ceramic shell mould systems suitable for casting high melting range alloys. Special problems are introduced because at high temperatures there is increased reactivity between the alloys and the mould materials. The thermodynamics of the relevant chemical reactions were reviewed for a number of high melting range metals and alloys. Refractory ceramic mould materials should retain their chemical stability in contact with the molten alloy. They should have a free energy of formation $\Delta G_f°$ comparable with, or preferably more negative than that for the oxides of the molten metals. The mould material should also have a high liquidus temperature in order to retain mechanical stability at the casting temperature. Casting defects can arise also because of mould surface penetration and this was discussed.

Dr Frye then described the lost wax shell-making process which basically consists on applying a facecoat layer to the wax pattern by dipping into a slurry and then constructing the shell mould around it by multiple dip coating. It is important to prevent the slurries from excessive ageing and this was discussed in detail. Finally, the mechanical properties of the mould were considered. Maximum strength and minimum creep can be achieved at critical amounts of binder in the slurry.

"Making Master Models from Thermoformed Plastic"

Jeffrey S. Matthews, Jeffrey Matthews Designs, USA.

Thermoforming is a process whereby a polymer sheet is heated until it is soft and then stretching it over a solid form of desired shape whilst applying a vacuum to the underside that will be in contact with the form. It is a widely used industrial process particularly for packaging foodstuffs. In this case, the formed shape is trimmed to remove excess material and the resulting model can be invested directly if one-off castings are desired or it can be used to make rubber moulds for mass production. Twenty-one advantages were listed which are too numerous to detail here. However, the highlights are that the time in making a master model is greatly decreased, thin sections can be produced, models can be used for castings or electroformed pieces, models have a long shelf life, the plastic sheet is inexpensive and the equipment is low cost (~$400 for a vacuform machine).

The presentation included a number of examples on how to make various types of models including forming on a natural object such as a leaf, undercut thermoforming, the addition of background textures and the characteristics of different polymers. Little was said on the burnout process apart from recommending a 12-hour cycle and it is hoped that a future presentation will give more information on this part of the casting process.

"Problems, Causes and their Solutions on the Stone-In-Place Casting Process: Latest Developments"

Dr Hubert Schuster, Director, Jewellery Technology Institute, Creazzo-Vicenza, Italy.

The stone-in-place casting process is now well established. The most obvious advantage is the reduction in setting time and labour costs. The stones can either be directly set in the wax model or they can be positioned in the rubber mould and the wax injected around the stones. The first method allows for any type of cut stone whereas the second is restricted to round stones. It is necessary to make modifications to almost every stage of the casting process and these were listed. Dr Schuster then discussed in detail the following most common problems, their causes and their solutions:-

1) diamonds have lost their shine and become white,
2) the stones have a black or dark rim after casting,
3) some stones have cracked or split,
4) the colour of the stones has changed,
5) the stones are covered with metal,
6) some stones have moved in the setting,
7) stones are not held solidly or have dropped out after casting.

"Mass Production of Gold and Platinum Wedding Rings Using Powder Metallurgy"

Peter Raw, Consultant to Engelhard-CLAL and the World Gold Council, UK.

The traditional ring manufacturing route of blanking washers from strip, pressing into cones and ring rolling was described and it was emphasised that this is time-consuming, labour intensive and material inefficient (typical yields being 25-30%). The economic advantages of a powder metallurgical process are reduced processing time and an increased product yield.

The process steps of powder production, powder compaction, sintering, pressing to the finished height (known as 'coining'), heat treating and ring rolling to finished size were described. After a feasibility study on a standard 9 carat gold alloy, the optimised manufacturing route was established. This involved

a) the production of pre-alloyed water-atomised powders sieved to <125µm,
b) pressing in a double-action hydraulic press to form compacted blanks,
c) sintering in a reduced atmosphere at 780°C,
d) 'coining' to the required ring height,
e) heat treating in a reducing atmosphere at 780°C for 24 h,
f) ring rolling to the required size,
g) final annealing.

The process steps and production equipment were described in detail.

Customer trials proved to be satisfactory. As a result, the total number of gold rings produced annually in six alloy types exceeds 200,000. The process has been simplified by increasing the sintering time to 24 h and omitting the heat treatment between 'coining' and ring rolling. The density of the rings is >99% of theoretical after ring rolling. The grain size is significantly finer than in traditionally produced rings and the hardness levels are slightly higher. A similar production route was given for platinum alloy rings although the sintering temperatures are much higher (~1450°C).

The presentation concluded by an examination of the technical and economic benefits offered by powder metallurgy processing. The finer grain size gives increased strength and wear resistance. Ring edges are easier to form leading to a reduction in finishing operations. Ductility is improved meaning that rings could be sized up ten finger sizes without annealing compared to two or three sizes for the traditionally produced rings. The overall yield was 85%, hence, giving a reduction in costs associated with scrap recycling and in the metal financing costs of ring production. The process cycle time was reduced from 10 days to 5 days giving a further reduction in metal financing costs and labour costs.

Editors note: Some of this work has been published in Gold Technology No 27, November 1999.

"Metallurgical Training Programs for Jewellery Manufacturers"

Greg Normandeau, Plant Manager, Imperial Smelting & Refining Co. of Canada Ltd.

Training programmes for staff at shop floor level have been used for many years at Imperial Smelting and Refining. The aim is to give a better understanding of the properties and behaviour of precious metals so that the incidents leading to defective material through mishandling can be reduced thereby enhancing productivity. After a brief review of the materials and processes used within the Company, Greg Normandeau outlined the course structure. This was initially based on American Society of Metals (ASM) programmes backed up with specific modules incorporating information from other sources such as journals and the Santa Fe Symposia. The publication of the "Technical Manual for Gold Jewellery" by the World Gold Council in 1997 was found by the speaker to cover the fundamentals in a less intimidating manner and is now being used in the course. The subject matter and the rationale for its inclusion in relation to the activities of the Company were described in detail. Initially, the programmes were focused on gold and silver materials but latterly, modules have been introduced for platinum.

Staff who took the programmes were encouraged to take the ASM-administered examinations. Feedback indicated that the ASM sections were a daunting task whereas the WGC Technical Manual was very specific to the trade and students expressed appreciation for the format, tables and photographs. A typical evaluation based on multiple-choice questions and answers was given in the presentation. The goal of the evaluations was to ensure that students understood the key concepts.

"Copyright and Patent Law Applied to the Manufacturing Jeweller"

Stephen Feldman, P.C., Feldman Law Firm, New York, USA.

The speaker dealt first with copyright protection as it applies to jewellery. This covers not only the final product but also each of the stages of processing from the design once it has been committed to paper. The importance of registering the copyright with the US Copyright Office was explained as this is necessary if a lawsuit for infringement is to be brought. The complexities of what can be registered were discussed with appropriate examples.

Stephen Feldman went on to draw the distinction between copyrights and patents. Essentially, a copyright is a positive right in that it confers the right to make the work. A patent confers a negative right in that it gives the right to stop others from using the invention but in itself it may infringe in some way on another patent. Application for a patent and patent law were discussed. It must be stressed that that the details given in the presentation are the law as it applies in the United States and that other countries may have different regulations, laws and interpretations.

"The Restoration of Antique and Period Jewelry"

Ricardo Eichberg, President E. Eichberg, Inc., USA.

Using a number of examples, the speaker described some of the techniques employed in restoring antique and period jewellery to their original design and function. These included the use of carefully monitored acid treatments to remove gold solders applied during repairs or modifications done by other jewellers, rebuilding damaged sections, and laser technology. Laser welding offers the advantages that heating is very localised, which may be important when gemstones are present in the item, and it may be easier to control and match the colour of a joint to its surroundings.

“Machining of Platinum Alloys for Jewelry - Part II”

Costantino Volpe, Tiffany & Co. and Dr Richard Lanam, Engelhard-CLAL, USA.

This presentation was a follow-up to the first part delivered at the 1999 Symposium (see *Gold Technology*, No.26, July 1999, p 33). The study has been extended to include additional and new platinum alloys. Surface texture and roughness were quantitatively assessed using a profiling contact skidded instrument. It was found that the machining parameters could be optimised for polycrystalline diamond cutting inserts and applied to a range of alloys and hardness. This was not the case for cermet inserts. The age-hardenable alloys have interesting machining characteristics, which need to be examined further.

“High-Speed Platinum Casting for the Small Shop”

Jurgen Maerz, Director of Technical Education, Platinum Guild International, USA.

Jurgen Maerz described the use of relatively cheap equipment to invest, burn-out and cast platinum in less than three hours. The investment is a modified dental investment which sets within 15 minutes and can then be directly placed into a furnace (kiln) pre-heated to 700°C for 90 minutes. After cooling the flask to about 260°C, it is placed in a simple vertical centrifugal casting machine. Melting is done using torch with an oxy-hydrogen flame. It has been possible also to successfully cast stones into place in platinum with this method. *Editor’s Note: This investment can also be used for casting carat golds!*

“Decorative and Functional Electrodeposits with Platinum Group Metals”

Erich Salomon, Consultant for Technic, Inc., USA.

Mr Salomon has presented papers at thirteen Santa Fe Symposia and these have covered many diverse aspects of precious metal processing technology as well as matters of security within the industry. This year he gave a comprehensive review of current plating practices and applications of electrodeposits of platinum group metals for jewellery. The importance of precious metal accountability was stressed with the need to have efficient metal recovery from drag-out solutions and spent baths.

“Practical Gem Identification for Manufacturing Jewellers”

Arthur Skuratowicz, Consultant and Julie Nash, Appraiser, Anton Nash, LLC, USA.

The polariscope and the refractometer are the primary instruments used in gemstone identification. These were described together with the underlying principles of optical physics. Their use in identifying different types of stones was given with many examples.

[The paper on “Observation Techniques for Gemstone Identification” given by Mr Skuratowicz at the 1999 Symposium is published in the 2000 Proceedings.]

“Jewelers Guide to Gemstone Handling”

Howard Rubin, President, GemDialogue Systems, Inc., USA.

This paper should be mandatory reading for those that work with gem-set jewellery, whether it be in manufacturing, repair work, or even sales. It includes a handy reference chart on the characteristics of various gemstones with regard to their reactions to many treatments used by jewellers, e.g. setting, polishing, heating, boiling and steaming, ultrasonic cleaning, pickling and plating. The presentation was interspersed with interesting and often amusing examples experienced by the speaker.

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Note: Details of the 15th Santa Fe Symposium to be held in May, 2001 are given on page 22.