THE 'FORSCHUNGSINSTITUT FÜR EDELMETALLE UND METALLCHEMIE'

Its 70th Anniversary & its Transformation into the FEM

William S. Rapson

This year marks the 70th anniversary of the Forschungsinstitut für Edelmetalle und Metallchemie in Schwäbisch Gmünd, Germany, and the 60th birthday of the present Director of the Institute, Prof. Dr. Christoph J. Raub.

These events were celebrated from 1st to 3rd July by a gathering in Schwäbisch Gmünd of some 277 guests and representatives of a wide range of institutions and industries. The development of the Institute was reported upon, its present fields of activity described and a changing of its name to 'The FEM' was announced.

In addition, a number of addresses were presented to honour the occasion. A brief report upon the proceedings, together with background information on the FEM is presented here.

*The author, Dr. W.S. Rapson, and Dr. C. Éluère,
Musée des Antiquités Nationales, St.-Germain-en-Laye, France*

The FEM came into being originally in 1922 with support from the state of Württemberg and industry. Schwäbisch Gmünd, a charming old city about 50 km east of Stuttgart, was chosen as its home. It was one of three main areas of activity of the noble metals industry in Germany, the others being Hanau and Pforzheim. It was also the site of a training school for craftsmen, namely the Staatliche Höhere Fachschule für die Edelmetallindustrie, which was able to house the newly formed Institute and in which members of its staff could take part in teaching. Its initial mandate included research in metallurgy, more particularly of the noble metals, the carrying out of independent assays and the establishment of training courses for the noble metals industry.

The first three directors of the Institute in its early years were Dr. Rudolf Vogel from the University of Göttingen, Dr. Hans Moser from the State Mint at Stuttgart, and later Dr. J.A.A. Leroux. In 1934 the

latter was succeeded in office by Dr. Ernst Raub from the University of München, and it was under his direction that the Institute's many and important contributions to the physical metallurgy of gold and other alloys really began. His personal contributions were considerable. His book 'Die Edelmetalle und ihre Legierungen', appeared in 1940 and he was the author or a coauthor of over 300 papers published from the Institute between 1934 and 1978.

These described some 27 studies of the constitutions of gold alloys, including those of binary gold alloys with a wide range of transition metals, and in addition a number of studies of ternary gold-copper alloys with silver, nickel, palladium, zinc and cadmium, and of ternary alloys

such as the gold-nickel-palladium and the gold-platinum-rhodium alloys. The constitutions of electrodeposited binary alloys of gold with such metals as copper, silver, lead, antimony, zinc, cadmium and bismuth were also studied. In the course of this work the complex problem of the electrodeposition of alloys, and in particular, of gold alloys, was extensively investigated and major contributions to both the science and technology of the plating of gold alloys were made. One of Dr. Ernst Raub's many honours was the 1974 Scientific Achievement Award of the American Electroplaters' Society. Studies of sputtered, evaporated and clad gold coatings were also initiated. The result was that this Institute gained world-wide renown for its work on precious metals, and in particular for its work on gold.

These developments were reviewed in *Gold Bulletin* [1] on the occasion of Dr. Raub's 70th birthday. At that stage he had retired as Director of the Institute and

was working as Senior Consultant and Adviser to his son Dr. Christoph J. Raub who was appointed to succeed him in 1970. Like his father, Dr. Christoph Raub received his initial training at the University of München. Thereafter he worked as a solid state physicist at the University of California for four years, and then as leader of the Metals Laboratory of W.C. Heraeus in Hanau. He was soon to demonstrate that he was a worthy successor to his father, and the flow of scientific and technical publications (547 in all) from the Institute over the period 1971-1992 has increased steadily both in volume and in scope.

This, and in particular the broadening of the scope of the Institute's work, has been facilitated by continuing financial support from both Federal and State sources, from the Deutsche Forschungsgemeinschaft, industrial research associations and individual companies. It has been supported by an active programme of technology transfer, through the medium of addresses, lectures, seminars

The old chemistry laboratory in 1930

and training programmes both in and outside Germany, and through the acceptance of guest workers in the Institute. At present the Institute has a staff of 55, of whom 20 are chemists, physicists or engineers, plus guest workers from various other countries. Their activities are concentrated in the following areas.

The various seals of the Institute over its 70 years of existence

NOBLE METALS

The earlier work on equilibrium phase diagrams has given way to studies of the technological properties of noble metal alloys and to the development of new alloys for both traditional and new applications. Studies of the deposition and technical properties of noble metal coatings are also included. The development and evaluation of noble metal alloys for use in dentistry is being actively pursued as well as various aspects of the use of noble metals in electronics and electrotechnology.

The use of noble metal alloys in jewellery is also still a field of special interest, and in this connection it is worthy of mention that the Institute played a sig-

nificant role in the development under the auspices of the erstwhile International Gold Corporation Ltd. of the new high-caratage gold-titanium alloy for use in jewellery.

SURFACE TECHNOLOGY

The earlier work on electrodeposited noble metal coatings has been extended so as to include the study of galvanic, chemical and other surface coatings of other metals. This includes development of coating processes, coating properties and product specifications, as well as work on such processes as the anodic oxidation of aluminium and magnesium. The susceptibility of surface coatings to corrosion and of their effectiveness in preventing corrosion of the substrates to which they are applied have also been studied.

The work in this area is now complemented by studies of physically deposited (evaporated, sputtered, etc.) metal coatings and their use on wearing surfaces, for corrosion protection, decorative applications, and in electronics, optical and radiant energy applications. The Institute is also well equipped for studies of the metastable phases that are a feature of some coatings of this type.

Evaluation of organic coatings used for the protection of metal structures in architecture and the cleaning and maintenance of anodized coatings have also received attention.

MATERIALS SCIENCE & SOLID STATE PHYSICS

Sophisticated facilities are available for evaluation of the technological properties and structures of both metallic and non-metallic materials, including studies

of electrical, magnetic and superconducting properties in relation to microstructures. The most modern equipment is also available for physical, chemical and metallographic characterization of bulk materials and of surfaces.

*The first class on gold electroplating (1929);
second from left: H. Krause, Dr. E. Raub and E. Bihlmaier*

ENVIRONMENTAL STUDIES

The Institute's activities in this field have been developed as a result of problems encountered in the plating industries with the treatment and handling of slimes and effluents. They have been extended as called for to enable it to investigate problems in respect of water supplies and of other industrial and effluents and wastes.

ARCHAEOOMETRY

Perhaps the most intriguing activity in the Institute, however, is the scientific and technical study of noble and other metal objects of archaeological origin. It has been involved in work in this area since its inception, and its accumulated experience and its armoury of modern techniques has made it most effective in this field.

THE NEW NAME OF THE INSTITUTE

It will be appreciated from the above that the Institute is no longer exclusively involved in the study of noble metals. Its activities have expanded and have moved progressively, though without prejudice to scientific studies, into technological aspects of the use of metals generally. In doing so however, it has selected special areas in which it will concentrate, and the most important of these is that of surface coatings technology. The purposefulness with which this is being pursued is indicated by the appointment of a specialist in this field, Dr. H. Jehn, as deputy director.

It is clear therefore that the science and technology of precious metals will have to compete for attention in the future with other fields of endeavour. This is an aspect of the present situation that might with advantage be noted by those involved in the use of noble metals, and of gold in particular.

THE PROCEEDINGS AT THE ANNIVERSARY CELEBRATIONS

These have been printed in booklet form along with a list of the publications of the Institute [2, 3]. They cover a wide range of topics including the following:

- Addresses by dignitaries and by representatives of sponsoring organisations and authorities
- A tribute in verse (41/2 pp.) to Prof. Dr. Ch.J. Raub by Prof. Dr. U. Zwicker of the University of Erlangen
- An account of the founding and development of the Institute by Prof. Dr. Ch.J. Raub

The assaying room of the Institute in 1928

- Anniversary addresses by:
 - Dr. C. Éluère (Musée des Antiquités Nationales, Paris) on 'Gold, silver and politics in early European Communities'
 - Dr. H. Jehn (FEM) on 'Archaeometry and Restoration'
 - Dr. W.S. Rapson (Johannesburg) on 'Precious metal and other mineral and metal resources of South Africa'
 - Dr. H. Prescher (Dresden) on 'Georgius Agricola, a European humanist from Saxony', 1494-1555.
- Papers on the activities of the Institute in selected fields:
 - Dr. Ch.J. Raub (FEM) on 'Classic fields of activity'
 - Dr. H. Pfeifer on 'Aluminium surface technology'
 - Dr. H. Jehn (FEM) on 'Physical surface and thin film technology'
 - D. Ott (FEM) on 'Environmental analysis and environmental techniques'

- A series of most interesting contributions from some 15 associated institutions – universities, technical high schools and industrial research and specialist centres in Saxony and Thuringia. One feature of these contributions was the cooperative spirit which pervaded all of them. Another was the preoccupation of all those involved in ensuring that the revision of the activities of various of the institutes, made desirable by the union of East and West Germany, takes place to the maximum benefit of all concerned.

This was a most interesting and informative occasion, which well merited the support given to it by gold producers, through the hosting of the concluding dinner by the World Gold Council, and by users of precious metals.

*The influence of 2 % Zn on the oxidation of 585 ct alloys
(left, with 2 % Zn; right, without)*

References

1. *Gold Bull.* 1975, 8(2) 56-59
2. 'Von den Edelmetallen zur Oberflächentechnik'; Addresses on the occasion of the 70th anniversary of the founding of the FEM, 1-3 July 1992, Forschungsinstitut für Edelmetalle und Metallchemie, Katharinenstraße 17, 7070 Schwäbisch Gmünd, Germany
3. FEM Publications 1928-1992, Forschungsinstitut für Edelmetalle und Metallchemie, Katharinenstraße 17, 7070 Schwäbisch Gmünd, Germany