performed at different pressures. When the critical pressure is exceeded, there is no liquid-gas phase transition; hence, no sudden change in the thermal expansion rate is observed. The results for temperature, pressure, and specific volume at the critical point of gold are as follows: $T_c = 7400 \pm 1100$ K, $p_c = 530 \pm 20$ MPa, and $v_c = 0.13 \pm 0.03 \times 10^{-3} \text{ m}^3 \text{ kg}^{-1}$.

10 REFINING

10.1 FTIR and EXAFS Investigations of Microstructures of Gold Solvent Extraction. Hydrogen Bonding Between Modifier and $\text{Au}(\text{CN})_2^-$

G. Ma, W. Yan, T. Hu, J. Chen, C. Yan, H. Gao, J. Wu, and G. Xu, State Key Laboratory of Rare Earth Materials Chemistry and Applications, College of Chemistry and Molecular Engineering, Peking University, Beijing, China, *Phys. Chem. Chem. Phys.*, 1999, 1(22), 5215-5221, have studied the structures of the loaded organic phases of three quaternary amine solvent extraction

systems for gold. N263-xylene, N263-tributyl phosphate (TBP)-dodecane and N263-2-ethylhexanol (isooctanol)-dodecane (N263 = trialkylmethylammonium chloride; alkyl = $\text{C}_8\text{-C}_{10}$) were studied by FTIR and EXAFS spectroscopy.

According to the EXAFS results, it was found that the gold coordination environment was the same before and after extraction. However, the $\text{C}\equiv\text{N}$ stretching vibrations of $\text{Au}(\text{CN})_2^-$ in the three systems differed greatly.

10.2 The Effect of Galvanic Interaction on the Behaviour of Free and Refractory Gold During Froth Flotation

This paper, by A.J. Teague, J.S.J. Van Deventer and C. Swaminathan, Department of Chemical and Metallurgical Engineering, Royal Melbourne Institute of Technology, Australia, *Int. J. Miner. Process.*, 1999, 57(4), 243-263, provides new information on the effect of galvanic contact between metallic iron and free gold, and gold locked in refractory iron sulfide minerals such as pyrite and pyrrhotite.

BOOK REVIEW

The Chemistry of Organic Derivatives of Gold and Silver

Edited by Saul Patai and Zvi Rappoport. Published by John Wiley and Sons Ltd (Chichester, New York, Weinheim), 1999, 734 pages, ISBN 0 471 98164 8. Price £300.00

The first chapter of this reference book is entitled 'General and Theoretical Aspects of Gold Compounds' by T. Hoz and H. Busch and includes data on a large number of $\text{Au}(\text{I})$ and $\text{Au}(\text{III})$ complexes, not all of which fall into a strict definition of what is usually taken to be organic derivatives – but the inclusion of related gold compounds does in fact add further interest to the chapter's content. The second chapter, by R.V. Parish, describes the Mössbauer spectroscopy of gold compounds, a technique used for determining the oxidation state of the gold. There is a chapter midway through the book on 'Synthesis and Uses of Organogold Compounds' by H. Schmidbaur, A. Grohmann, M.E. Olmos

and A. Schier, and this includes sections on the synthesis of σ -bonded organogold complexes, homo- and hetero-metallic gold clusters containing gold-carbon bonds, and the synthesis and properties of alkene, alkyne, carbene and related complexes of gold. Towards the end of the book there are valuable chapters on 'Gold-Thiol Self-Assembled Monolayers' by V. Chechick and C.M. Stirling and 'Medicinal Chemistry of Organogold Compounds' by S.P. Fricker – amongst the applications for monolayers are their use in microelectronics, sensor devices and for anchoring liquid crystals; and gold compounds are used in the treatment of rheumatoid arthritis and have potential for use with some other diseases.

Most of the remaining eleven chapters deal with various other aspects of both gold and silver chemistry, although one of them is solely on the synthesis and uses of organosilver compounds. The topics dealt with jointly include the thermochemistry of the organometallic compounds by J.F. Liebman, J.M. Simões and S.W. Slayden; their NMR and ESR spectroscopy by C.F. Shaw III; their photoelectron spectroscopy by I. Novak;

analytical aspects by J. Zabicky and S. Grinberg; their electrochemistry by A.A. Mohamed, A.E. Bruce and M.R.M. Bruce; their organic photochemistry by W.M. Horspool; the pyrolysis of organic derivatives by R.A. Aitken; their acidity, basicity and hydrogen bonds by T.M. Klapötke; their rearrangements by S. Wang and J.P. Fackler Jr; and the synthesis of isotopically labelled compounds by M. Zielinski, M. Kanska and R. Kanski.

Overall the book demonstrates that a wide range of different types of organic derivatives of gold and silver can be prepared and it is clear that further investigations will continue to enlarge the number and variety of such compounds available. There is a wealth of detailed information in this book with many useful tables, formulae, equations, graphs, and references; and there are good author and subject indices. This publication is to be recommended as a reference book for all those interested in gold chemistry, both in academia and industrial circles.

David Thompson