films, which were evaporated in vacuum, has shown that the number of growth twins decreases with increasing crystallite sizes. This tendency results in the complete absence of twin lamellae in single crystal films (17). The analogous behaviour of twins in films of other materials has been observed, for example, in β-silicon carbide (18). Growth twins are dangerous features in foils as they can be the embryo for both deformation and annealing twins (19).

In conclusion, some recommendations can be formulated for the selection of the optimum conditions for processing iridium. The main condition is that the material must be kept free from non-metallic impurities during all stages of manufacture. Grain boundaries are danger points in work pieces, especially if the average grain size is of the order of some millimetres. Therefore it is desirable that single crystal or fine grained polycrystalline work pieces are used. The tensile stresses must be kept to a minimum level; in our case at the mechanical working stage, the large crystals were first forged and after that they were subjected to rolling. The optimal temperature range for processing iridium work pieces is 500 to 900°C as the material is plastic at these temperatures, but recrystallisation does not take place. Also, the processing of iridium in this temperature range can be undertaken in air as intensive oxidation only takes place at 1000°C and above. Processing at temperatures lower than the recrystallisation temperature prevents formation of additional danger points in work pieces such as new grain boundaries and twins.

References

1 J. R. Handley, *Platinum Metals Rev.*, 1986, **30**, (1), 12

2 I. E. Cottington, Personal communication, 1990

3 S. S. Hecker, D. L. Rohr and D. F. Stein, *Metall. Trans.*, 1978, **9A**, 481

4 C. A. Brookes, J. H. Greenwood and J. L. Routbort, *J. Appl. Phys.*, 1968, **39**, 2391; *J. Inst. Met.*, 1970, **98**, 27

5 P. Haasen, H. Hieber and B. L. Mordike, *Z. Metallkd.*, 1965, **56**, 832

6 C. N. Reid and J. L. Routbort, *Metall. Trans.*, 1972, **3**, 2257

7 S. P. Lynch, *Mater. Forum*, 1988, **11**, 268; *Acta Metall.*, 1988, **36**, 2639

8 B. L. Mordike and C. A. Brookes, *Platinum Metals Rev.*, 1960, **4**, (3), 94

9 D. L. Rohr, L. E. Murr and S. S. Hecker, *Metall. Trans.*, 1979, **10A**, 399

10 P. Panfilov, A. Yermakov, G. Baturin and A. Timofeev, *Fiz. Metal. Metallovedenie*, (in Russian), 1989, **67**, 813; A. Yermakov, P. Panfilov and R. Adamesku, *J. Mater. Sci. Lett.*, 1990, **9**, 696; P. Panfilov, A. Yermakov and G. Baturin, *ibid.*, 1990, **9**, 1162

11 C. Gandhi and M. F. Ashby, *Scripta Metall.*, 1979, **13**, 353; *Acta Metall.*, 1979, **27**, 1565

12 I. M. Robertson and H. K. Birnbaum, *Acta Metall.*, 1986, **34**, 353

13 G. Reinacher, *Z. Metallkd.*, 1967, **58**, 831

14 R. E. MacFarlane, J. A. Rayne and C. K. Jones, *Phys. Lett.*, 1966, **20**, 234

15 R. Adamesku, V. Barkhatov and A. Yermakov, *Vysokochistie Veschestva*, (in Russian), 1990, (3), 219

16 G. G. Garrett and J. F. Knott, *Acta Metall.*, 1975, **23**, 841

17 A. S. Solov'iov, Communication on XIII Conference, "Recitation, Physical Properties and Applications of High Purity and Single Crystal Refractory and Rare Metals", October 1990, Suzdal, U.S.S.R.

18 K. Koumoto, S. Takeda, C. H. Pai, T. Sato and H. Yanagida, *J. Am. Ceram. Soc.*, 1989, **72**, 1985

19 J. W. Matthews, *Acta Metall.*, 1970, **18**, 174

Ammonia Sensor Uses Platinum Films

There is a need to measure ammonia gas concentrations under clinical and industrial conditions, and for environmental protection.

Now researchers at the C.S.I.C., Spain, have developed a new ammonia gas sensor device based on Schottky platinum/*n*-gallium arsenide barrier diodes with discontinuous platinum films which have excellent sensitivity between room temperature and 150°C (L. M. Lechuga, A. Calle, D. Golmayo and F. Briones, *J. Appl. Phys.*, 1991, **70**, (6), 3348–3354).

The devices have a dual metallic configuration consisting of a thick deposited platinum circular dot and a thin porous platinum film evaporated over and outside the contact dot. Gas-induced modification in Schottky diode electrical properties are monitored by measuring changes in the diode capacitance as a function of time.

In synthetic air it was possible to measure ammonia concentrations above 150 ppm with response times lower than one minute.