

with the possible implications for mechanical behaviour. The effects of both alloying and impurity elements on the mechanical behaviour of iridium were discussed in another invited talk by E. P. George (Oak Ridge National Laboratory, U.S.A.). Segregation of trace elements to grain boundaries can result in improved alloy ductility for elements such as thorium and cerium or dramatically reduced ductility for impurities such as silicon and phosphorus. Interestingly, in a subsequent presentation by D. F. Lupton it was shown that heating iridium with a small addition of silicon to near the melting point results in silicon migrating away from the grain boundaries, with no loss of strength or ductility. In contrast, iron impurities, which George showed to have little effect on ductility at high strain rate, were found by Lupton to decrease creep properties.

Eight papers were presented on the topic of iridium-based and iridium-containing alloys with significant quantities of ordered phases. Hafnium, zirconium, niobium and tantalum were reported by Y. Yamabe-Mitarai (National Research Institute for Metals, Japan) to produce ordered phases with improved mechanical properties to 1200°C but without beneficial effects at higher temperatures. Superior compressive yield strength at 1200°C was shown by Y. F. Gu (National Research Institute for Metals, Japan) for an Ir-15% Nb alloy with a nickel addition. H. Hosoda (University of

Tsukuba, Japan) reported on the improved oxidation resistance in an IrAl compound alloyed with nickel. The oxidation resistance of (Ir,Ru)Al alloys increased with increasing iridium content, while additions of boron to Ir-Al decreased the oxidation resistance (P. J. Hill and I. M. Wolff, Mintek, South Africa). Other presentations dealt with quaternary Ir-Nb-Ni-Al alloys, X. H. Yu (National Research Institute for Metals, Japan). Iridium additions to NiAl single crystals were discussed by A. Chiba (Iwate University, Japan), while H. Hosoda (University of Tsukuba, Japan) described iridium additions to FeAl alloys. The effect of low-pressure oxygen atmospheres on grain growth in iridium alloys was summarised by C. G. McKamey (Oak Ridge National Laboratory, U.S.A.). Diffusion in the Ir-Re system was reported by A. Smirnov (Engelhard-CLAL, U.S.A.).

The proceedings of the international symposium, "Iridium", ISBN: 0-87339-461-5, edited by E. K. Ohriner, R. D. Lanam, P. Panfilov and H. Harada, are available from TMS, 184 Thorn Hill Road, Warrendale, PA 15086, U.S.A. Cost: U.S.\$94.00, Member: U.S.\$68.00, Student: U.S.\$50.00, Tel: +1-(724)-776-9000, URL: <http://www.tms.org/pubs/Publications.html>.

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Palladium Oxide Layers as Damage Markers in RAMs

Materials being investigated to replace the traditional dielectrics used for memory storage, in DRAM (direct random access memory) and NVD RAM (nonvolatile DRAM), capacitors, include high permittivity (high-epsilon (HE)) and ferroelectric (FE) perovskites, such as (Ba,Sr)TiO₃ and SrBi₂Ta₂O₉. The materials for the electrodes used in these capacitors must be able to withstand the high-temperature oxidising conditions needed to deposit the perovskites, so noble metals and/or their conductive oxides have been tested, and platinum, in particular, has improved device properties. However, the reducing environments needed to process the devices can damage the perovskite, by loss of oxygen, resulting in high device leakage.

Scientists at IBM in New York, U.S.A. have

now found a way of monitoring the damage to the perovskites (K. L. Saenger, C. Cabral, P. R. Duncombe, A. Grill and D. A. Neumayer, *J. Mater. Res.*, 2000, 15, (4), 961-966). They found an additional decomposable PdO bottom electrode could act as a marker for observing any damage to the perovskite from the reducing environment. Oxygen loss from PdO layer films with and without a HE/FE overlayer was monitored by *in situ* XRD during heating in an inert ambient. The Pd could lose or gain oxygen or form a Pd-Pt alloy with an underlying Pt layer. Oxygen could cross the HE/FE in both directions. The Pt underlayer reduced the temperature at which oxygen left the PdO. The PdO layer could thus act both as a monitor and as an oxygen source for the perovskite.