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Symposium Q: Fundamentals of Nanoindentation and Nanotribology II

Yielding and the Indentation Size Effect in Iridium [1]

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Iridium alloys have several properties that make them excellent model materials in nanoindentation studies. They have high resistance to oxidation, a large elastic modulus (560 GPa) and a relatively low yield stress (160 MPa for Ir-0.3 pct W). From nanoindentation experiments with a 69 micron radius spherical indenter, the yield stress of Ir-0.3 pct W was determined to be 2.9 GPa. This value is 18 times the yield stress of the bulk material, but still much lower than the shear modulus (225 GPa) and the theoretical yield strength of the material. The origin of this behavior is examined through experiments conducted with spherical indenters of various radii. Nanoindentation experiments with a Berkovich indenter show a large indentation size effect, which extends to much greater depths than in most materials. For the Berkovich indenter, hardness values ranged from 3.1 GPa at a contact depth of 2.7 microns to 5.9 GPa at a contact depth of 0.37 microns. The indentation size effect appears to extend into the microhardness regime and possibly into the macrohardness regime in iridium alloys.

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