Mechanochemical Synthesis and Applications of New IrB2 and IrB Powders

Disclosure Number

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Technology Summary

Two new AlB2- and ReB2-types of iridium diborides (IrB2), and an orthorhombic iridium monoboride (IrB) were synthesized for the first time by the mechanochemical method, i.e., high energy ball milling. The formation of the new phases has been confirmed by X-ray diffraction and tranmission electron microscopy. These new iridium borides are expected to have ultra-high hardness, high oxidation resistance and catalytic activity. The ultra-high hardness allows the iridium borides to be used as cutting tools, polishing materials or wear resistant coatings. The high oxidation resistance at high temperature allows the materials to be used as thermo-oxidation protection layers for spacecraft, ultra-high speed vehicles, etc. Iridium segregation along disordered domains in boron lattice forming Ir clusters and linearly distributed iridium atoms were observed. This implies that the scattered iridium atoms possess very high catalytic activity, which can be a superior catalyst for combustion and fuel cells. Thus, the discovery of these new iridium borides will bring great impact to industrial applications. Besides, the mechanochemical synthesis is scalable, energetically efficient and environmentally friendly. These advantages enable large quantities of production with low energy consumption and pollution.

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