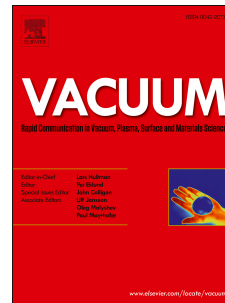


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Electrical resistivity modulation of thermoelectric iron based nanocomposites

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ABSTRACT

Iron oxides are promising thermoelectrics, but their high electrical resistivity impedes broader applications. In this work, we have studied Fe oxides with metallic contributions. Pt and Ir additions are also considered to enhance the valence electron concentration and further modify the transport properties. Based on density functional theory explorations, Fe based clusters (Fe₃, Fe₄, and Fe₃Pt) are suggested to act as nucleation sites for metallic crystallites, while O leads to formation of an amorphous matrix. This has been validated by transmission electron microscopy and x-ray photoelectron spectroscopy of sputter-grown Fe-Pt-Ir-O thin films. Densely packed bcc Fe grains, approx. 2 – 3 nm in diameter, are embedded in an amorphous Fe-O matrix in the as-grown state. The Seebeck coefficient reaches even $-411 \mu\text{V K}^{-1}$ and the electrical resistivity is up to 5 orders of magnitude lower than that of previously reported literature data on Fe oxides.

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