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Effect of Mn addition on the ductility of FeCo soft magnetic alloy

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Abstract: FeCo alloy plays an important role in soft magnetic materials with a wide range of technological applications due to its high saturation magnetization and Curie temperature. However, this alloy shows low levels of ductility at room temperature. The ductility of this alloy can be improved by the ternary addition of Manganese (Mn). In this study, a supercell approach was used to generate B2 Fe50Co50-XMnX structures (0≤X≤50), and different properties were evaluated to determine their ductility and stability at room temperature. Both binary and ternary structures were fully optimized to obtain better equilibrium ground-state properties such as lattice parameters and thermodynamic properties. The results obtained from the FeCo system gave equilibrium lattice parameter and heats of formation which are in good agreement with the experimental findings to within 1%. The ductility and brittleness behavior of the B2 Fe50Co50-xMnx alloys was evaluated through the three quantities: Poisson's ratio, the B/G ratio, and the Cauchy pressure at different compositions. The findings confirm that alloying with Mn effectively improved the ductility. It was also found that the ternary addition of Mn to the FeCo system resulted in enhanced magnetic properties. The findings reveal that Fe50Co50-xMnx alloys can be used in the future development of magnets.

Keywords: FeCo soft magnetic alloys, Supercell approach, Magnetic properties, Ductility

Apply to be considered for a student ; award (Yes / No)?

Yes

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MSc

Primary authors: LEDWABA, Tebogo (University of Limpopo); Mrs DIALE, Ramogohlo (UL); NGOEPE, Phuti (University of Limpopo); Prof. CHAUKE, Hasani (UL)

Presenter: LEDWABA, Tebogo (University of Limpopo)

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