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# Microstructure and thermal stability of nanocrystalline Mg-Gd-Y-Zr alloy processed by high pressure torsion

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## Abstract

**Fabricating bulk coarse-grain Mg alloys into nanocrystallines (NCs) via severe plastic deformation along with remaining the thermal stability of nanostructures has been a challenging issue.** Here we employed high-pressure torsion at room temperature to prepare nanocrystalline (NC) Mg-Gd-Y-Zr alloy with an average grain size of 80 nm. The appearance of NC structures was associated with stacking fault formation, due to the lowering of stacking fault energy by Gd and Y according to the density-functional theory (DFT) calculations. The NC Mg-Gd-Y-Zr alloy showed high thermal stability up to 250 °C, which is comparable with that of its coarse-grained and fine-grained counterpart. **This high thermal stability against nanograin growth was caused by stable precipitation at grain boundaries.** Therefore, alloying Mg with Gd and Y not only helped with formation of NCs, but also improved the thermal stability.

**Keywords:** Magnesium; alloying; nanocrystalline; plastic deformation; density-functional theory calculations; thermal stability.