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Microstructure refinement and magnetic properties enhancement for nanocomposite $\text{RE}_2\text{Fe}_{14}\text{B}$ alloys by Zr additions

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ABSTRACT

The effects of Zr-substitution on the microstructure and magnetic properties of $[(\text{PrNd})_{0.32}\text{La}_{0.22}\text{Ce}_{0.46}]_{22.0}\text{Fe}_{76.7-x}\text{Zr}_x\text{B}_{1.3}$ ($x=0, 2.5, 5, 7.5$ wt%) melt-spun powders have been investigated. It is shown that the Zr addition can prevent the formation of CeFe_2 phase and $\alpha\text{-Fe}$ phase, increasing the volume fraction of 2:14:1 phase. Furthermore, the Zr addition can refine the grain sizes of $\alpha\text{-Fe}$ and 2:14:1 phases. Meanwhile, the formation of Fe_2Zr phase and the decrease of CeFe_2 phase improve its antioxidation. And the magnetic properties of bonded magnets are found to increase significantly. The coercivity H_{cj} increases from 2.57 kOe for the Zr-free sample to 5.86 kOe for the Zr-doped sample. The maximum energy product $(BH)_{\max}$ of bonded magnets increases from 3.13 MGOe to 6.19 MGOe correspondingly, which attribute to the fine microstructure.

Keywords: microstructure; composition; magnetic properties; Zr addition

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