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Development of RE-Fe-B melt-spun magnetic powders for high-temperature applications

Melt-spun Nd–Fe–B-based magnetic powders have been successfully applied in bonded magnets for a wide variety of modern applications from office automation, power tools to automotive devices and computer components. In this paper, we will review our R&D efforts in developing high-temperature melt-spun RE-Fe-B powders for automotive industry and/or power tool applications, where good thermal stability is the main requirement. We will report our studies on effects of various substitutions (Dy for Nd and Ce for NdPr, refractory metals Cr, V, Ti, Mo, Nb, Zr and Co for Fe) on thermal stabilities of Nd-Fe-B melt-spun powders and on flux aging losses in their bonded magnets. Our research has found that Nb and Zr provide the best overall properties among all substitutions studied, making Dy additions unnecessary to produce high-temperature powders for applications up to 180°C. We have also achieved good thermal stability in (NdPrCe)-Fe-Zr-B melt-spun powders. Bonded magnets suitable up to 125°C can be produced with Ce up to 70% of the RE concentration and suitable to 150°C up to 50% Ce substitution. Good thermal stability using low cost Ce may lead to wide spread acceptance of bonded magnets in automotive and HVAC applications.