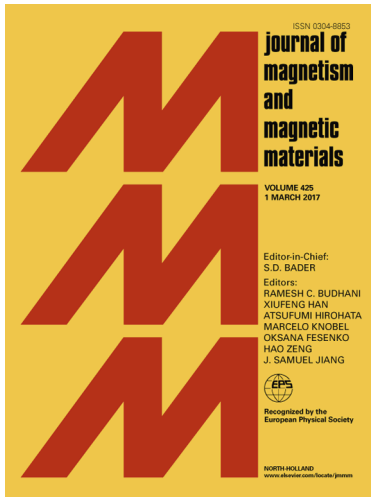

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High coercive Zn-bonded Sm-Fe-N magnets prepared using fine Zn particles with low oxygen content

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Abstract

To improve the coercivity of Zn-bonded Sm-Fe-N magnets, fine Zn particles with low oxygen content were fabricated by the hydrogen plasma-metal reaction (HPMR), and Zn-bonded Sm-Fe-N magnets were prepared using the Zn particles. The primary and secondary average Zn particle sizes were 0.23 and 0.93 μm, respectively, and the oxygen content was 0.068 wt%. The oxygen content in the Zn-bonded Sm-Fe-N magnets prepared using the Zn particles also decreased, and the coercivity and energy products of the 15 wt% Zn-bonded Sm-Fe-N magnets were 2.66 $MA \cdot m^{-1}$ and 53.1 $kJ \cdot m^{-3}$, respectively, at room temperature. The 10 wt% Zn-bonded Sm-Fe-N magnet was also a high coercivity value of 2.41 $MA \cdot m^{-1}$, and the energy product was 56.1 $kJ \cdot m^{-3}$. The coercivity strongly depended on the oxygen content rather than the particle size of Zn, and decreasing the oxygen content in the starting material improved the magnetic properties of Zn-bonded Sm-Fe-N magnets. The coercivity of the 15 wt% Zn magnet measured at 180 and 200 °C was 1.23 and 1.10 $MA \cdot m^{-1}$, respectively, and the temperature coefficient of coercivity was -0.32 $\%\cdot°C^{-1}$.

Keywords: Zn-bonded Sm-Fe-N magnets, coercivity, oxygen content, fine Zn particle

1. Introduction

$Sm_2Fe_{17}N_3$ compound has excellent magnetic properties of high saturation magnetic polarization (J_s), a large anisotropy field, and a high Curie temperature.[1,2] However, $Sm_2Fe_{17}N_3$ cannot be used in sintered magnets because it decomposes above approximately 600 °C. Therefore, $Sm_2Fe_{17}N_3$ is used in bonded magnets with polymer or metal binders.

Otani *et al*.[3] investigated the magnetic properties of metal-bonded $Sm_2Fe_{17}N_3$ magnets using Zn, Bi, Sn, and Al with low melting points. They reported that the Zn binder improves the coercivity of the Sm-Fe-N bonded magnets and that the coercivity of the magnets is higher than that of other metal-bonded Sm-Fe-N magnets. They also found that the appearance of Zn_7Fe_3, which can be described as the Γ-FeZn phase, increased the coercivity. Hiraga *et al*.[4] observed the microstructure of Zn-bonded Sm-Fe-N magnets and concluded that substituting Zn for Fe at