Phase transformation, structure and magnetic properties of Nd9.4Pr0.6FebalTixCxCo6Ga0.5B6 ribbons prepared by melt-spinning method

ABSTRACT

The effect of Carbon and Titanium additions on the phase constitution, microstructures and the magnetic properties of Nd-Fe-B isotropic nanocomposite processed from Nd9.4Pr0.6FebalCo6B6Ga0.5TixCx (x=0, 3, 6) ribbons has been investigated. As-spun ribbons were examined by using X-ray diffractometry (XRD) and differential scanning calorimetry (DSC). Optimally quenched and annealed Nd9.4Pr0.6FebalCo6B6Ga0.5TixCx (x=0, 3, 6) ribbons at 750 °C for 10 minutes, which was composed of Nd2Fe14B grains separated by Ŭ-Fe grain boundary phase, shows addition of Ti suppresses formation of primary Fe and promotes formation of ferromagnetic iron-borides. Carbon addition is effective for grain refinement and suppression of unfavourable formation of TiB2; resulting in improvement of magnetic properties. The results show that Titanuim and Carbon additions enhance the glass forming ability and increase the crystallization temperature. XRD results of annealed ribbons indicate that Ti and C react to form TiC. The grain size was substantially refined by the addition of Ti due to the formation of Ti-enriched amorphous grain boundaries. The XRD and Atomic force microscope (AFM) technique results confirm that grains are in the size of less than 70 nm. Furthermore, addition of C enhanced the enrichment of Ti in the grain boundary phase, which led to the increase of the coercivity and the maximum energy product.

Keyword: Melt spinning; Nanocomposite magnet; Nd-Fe-B magnets