

Synthesis of Cu-coated Ni-based Bulk Metallic Glass Powders by Gas Atomization and Spray Drying Process

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Abstract

Bulk amorphous materials have been intensively studied to apply for various advanced industry fields due to their high mechanical, chemical and electrical properties. These materials have been produced by several techniques such as mechanical alloying, melt spinning and gas atomization, etc. Among them, the atomization is the most potential technique for commercialization due to high cooling rate during solidification of the melt and mass productivity. However, the amorphous powders still have some limitations because of their low ductility and toughness. Therefore, intensive efforts have to be carried out to increase the ductility and toughness. In this study, the Ni-based amorphous powder was produced by the gas atomization process. And in order to increase the ductile toughness, ductile Cu phase was coated on the Ni amorphous powder by spray drying process. The characteristics of the as-synthesis powders have been examined and briefly mentioned. The master alloy with $\text{Ni}_{57}\text{Zr}_{20}\text{Ti}_{16}\text{Si}_2\text{Sn}_3$ was prepared by vacuum induction melting furnace with graphite crucible and mold. The atomization was conducted at 1450°C under the vacuum of 10^{-2} torr. The gas pressure during atomization was varied from 35 to 50 bars. After making the Ni amorphous powders, the spray drying was processed to produce the Cu-coated Ni amorphous composite powder. The amorphous powder and Cu nitrate solution were mixed together with a small amount of binder and then it was sprayed at temperature of 130°C and rotating speed of 15,000 R.P.M..