Microporosity Control and Characterization of Nanocrystalline Porous NiTi Shape Memory Alloy

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Abstract

Production of Nanocrystalline NiTi alloy from elemental powders was conducted by mechanical alloying (MA) and sintering of the raw materials .Effects of milling time and milling speed (RPM) on crystallite size, lattice strain and X-ray diffraction intensity ratios were investigated by XRD analysis of the products. Observations showed that the crystallite size of the mechanically alloyed NiTi samples decreases with increasing the MA duration and milling speed (RPM).The lattice strain depended on the crystal Nanostructure of the elements and enhanced with the milling duration. Influences of powder compaction pressure, sintering time and sintering temperature on pore percentage and densification of the specimens were determined. Sintering lowered the porosity of the samples. Porosity content decreases with increasing of sintering time, temperature and pressure due to their sharper liquid phase sintering effect.

Sintering Behavior of TiC-Fe Base Composite Fabricated by Spark Plasma Sintering Using TiH2-Graphite Powders

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Abstract

Ceramic-metal composites based on the Fe-TiC system can be synthesized by spark plasma sintering of the D'AE powders with TiH2-graphite powders under vacuum in the temperature range 1000-1200℃ for 5-20 min. Milled powders fabricated during 1-5 hours by spex shaker mill, ball and powders ratio was 0.08(ball weight was 250g) under argon atmosphere. The volume percentage ratio of Fe:45%TiC can be controlled through Fe-TiH2-graphite adjustment of the reactant materials. Combustion reaction of TiH2 with graphite results in the formation of a fine powder consisting of titanium hydride and carbide, as summarised in Eq.: Fe+TiH2+C→Fe+TiC+H2(g). TiC phase was formed by self combustion reaction during temperature increasing. Specimen formed sintering Fe-TiC powders display a microstructure of uniformly dispersed TiC grain in a continuous metal matrix. The densifications of the TiC-Fe materials was increased by varying the heat-treatment maintenance temperature, the particle size of TiC was increased. Most of the specimen was observed to occur below the liquid phase formation temperature.