SYNTHESIS OF NANOCRYSTALLINE Ni3Al BY MECHANICAL ALLOYING

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The successful synthesis of nanoparticles of the Ni3Al intermetallic by Mechanical Alloying is reported from a stoichiometric mixture of metal powders of high purity nickel (99.99%) and aluminum (99.99%) with a molar ratio of 3:1. The process was performed under argon atmosphere at room temperature using a horizontal ball mill with stainless steel spherical grinding media. The ball-to-powder weight ratio is 36:1 and the rotation speed of vial was 110 rpm. Methanol was used as process control agent. The milling was interrupted at selected time intervals and small amount of the corresponding milled powders was collected for characterizations. The phase evolution and microstructural changes of the powders during mechanical alloying were analyzed by means of X-ray diffraction, scanning electron microscopy and transmission electron microscopy. The results showed that during the shortest milling periods, a supersaturated solid solution of Ni (Al) is formed. At longer processing times, the nanocrystalline intermetallic Ni3Al in its disorderly manner is present. The analysis of the XRD patterns allowed the calculation of the crystal size by the Scherrer formula obtaining a value of 10.31 nm for longer MA. The analysis of the select area diffraction pattern of the powders confirm the nanometric features by appearing of super lattice reflections that were indexed.

Keywords: nanocrystalline, intermetallic, mechanical alloying

References:


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