

The Structural and Magnetic properties of $\text{Ni}_{45}\text{Al}_{45}\text{C}_{10}$ Solid Solution as a Function of Milling times

Kontan Tarigan^{1,4*}, Yong-Go Yoo², Dong-Seok Yang³, Ni Luh Karina Kartika¹, Seong-Cho Yu¹

¹Department of Physics, Chungbuk National University, Cheongju 361-763, South Korea

²Regional Innovation Agency, Chungbuk Technopark, Cheongwon 363-883, South Korea

³Physics Division, School of Science Education, Chungbuk National University, Cheongju 361-763, South Korea.

Introduction

Nanoparticles have been studied currently due to a wide variety of potential applications in biomedical, optical, and electronic fields.

NiAl inter-metallic compounds have low density, high strength and good corrosion and oxidation resistance.

Carbon added magnetic alloys which are commonly used in industry, have been extensively studied due to their nano-composite structure originating a complicated phase change strongly dependent on the carbon concentration.

Mechanical Alloying (MA) has been used widely to prepare metastable phases such as supersaturated solid solution, amorphous phases and nanostructure powders.

Experiment

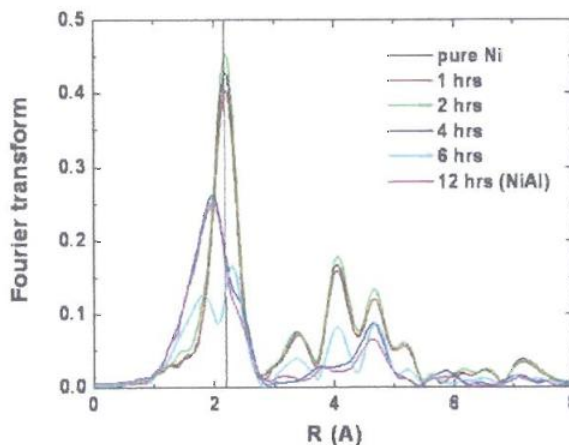
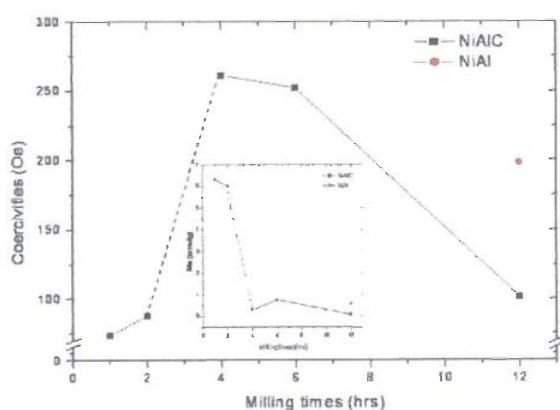
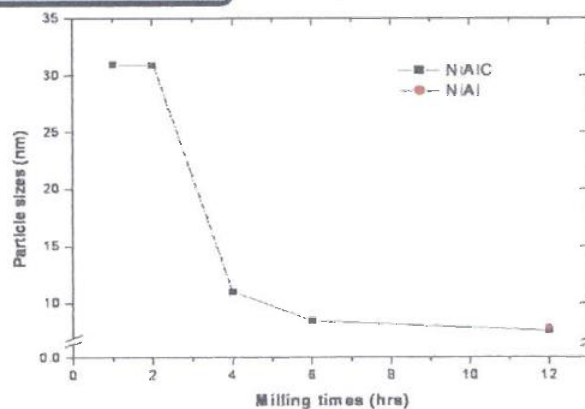
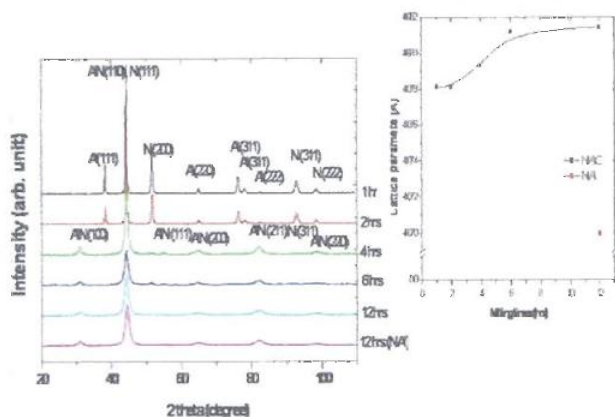
Mixtures of appropriate amounts of Ni, Al, and C powders were mechanically alloyed (MA) by using a SPEX 8000 mixer and mill with stainless balls and vial under an Ar atmosphere to prevent oxidation of the alloy.

Structural change for prepared samples was examined by XRD and EXAFS spectroscopy. EXAFS experiments were carried out at the beam line 3C1 EXAFS of the Pohang Light Source (PLS) in the Pohang Acceleratory Laboratory (PAL) in Korea. The PLS was operated with an electron energy of 2.5 GeV and maximum current of 164.813 mA.

Calculating of particle sizes using Scherrer formula.

The magnetic properties of the powered alloys milled for different times were studied by vibrating sample magnetometer (VSM).

Results and discussions



Conclusions

Nanostructured $\text{Ni}_{45}\text{Al}_{45}\text{C}_{10}$ alloys have been prepared by MA starting from elemental components.

XRD profiles and lattice parameter indicate the formation of alloy with increasing milling time.

The EXAFS studies revealed local structural properties of the alloy with milling time. According to the results, we could assume that Al, Ni and C atoms inter-diffuse each other with increasing milling time which has gives rise to formation of the nano-structured alloy.

The value of magnetization were decreased as increasing milling time, which is explained by magnetic dilution. The value of coercivity of sample was decreased significantly as an effect of carbon on NiAl substance.