

Tuesday Evening Poster Sessions

Manufacturing Science and Technology

Room: Hall 3 - Session MS-TuP

Aspects of Manufacturing Science and Technology Poster Session

MS-TuP1 Development of Graphene/Al Composite Materials with High Strength, Yusuke Oguro, A. Matsumuro, Aichi Institute of Technology, Japan

Graphene shows many extraordinary properties. It conducts heat and electricity with great efficiency and is nearly transparent. Furthermore it has the surprisingly mechanical properties with tensile strength of 100 times stronger than steel by weight and Young's modulus with 1 TPa. Now the field of the electronic device is studied energetically. But, studies are hardly investigated in the field of the application to new composite materials. The properties show superior high specific strength. We are convinced that they greatly contribute to develop the innovative materials and overcome environmental problem.

In this study, we focused on graphene/Al composite bulk materials. As graphene materials, we used nanographene with a several layers due to large quantity production and very cheap. Firstly we investigated the method of synthesis of monolayer nanographene sheet by our original ultrasonic vibration method in order to utilize original high strength characteristics of monolayer graphene sheet. We must also prevent from aggregation of graphene sheets in composite materials because the aggregation parts would surely cause a loss of strength of the materials. In order to disperse graphene around Al powders with average diameter of Al about 100 nm, the same ultrasonic vibration method was applied with isopropyl alcohol as a solvent before sintering composite materials. The powder before press sintering was prepared to dry in a furnace at about 340 K for 40 minutes. The composite materials with uniform dispersion of graphene were fabricated by with piston-cylinder type press apparatus under the condition of the applied pressure of 1 GPa and the temperature of 723 K for 4 hours in Ar gas atmosphere. We investigated the optimal condition of the composite materials as changing dispersion time by ultrasonic vibration from 1 to 6 hours. And we also investigated the optimal condition of the composite materials as changing composition rates from 0 to 3.0 wt.% graphene.

In our results, all composite materials sintered showed uniform bulk materials without aggregation of graphene. X-ray diffraction showed no metallic compounds between Al and nanographene. The densities of composite materials decreased down to 2.43 g/cm³ of 3.0 wt.% graphene. Vickers hardness of the composite material at 1.0 wt.% graphene showed the maximum value of 308 Hv, and the density was 2.46 g/cm³. So, the specific strength increased up to 396 kN · m/kg. It is about 1.4 times bigger than that of Al material. Therefore, graphene/Al composite materials give us dreams of development for innovative materials.

Authors Index

Bold page numbers indicate the presenter

— **M** —

Matsumuro, A.: MS-TuP1, 1

— **O** —

Oguro, Y.: MS-TuP1, 1