

Boron Nitride Nanotube Reinforced Magnesium Composite by Spark Plasma Sintering

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Boron Nitride Nanotube (BNNT) is a high strength, high stiffness and highly thermally stable lightweight nanomaterial. BNNTs are appealing for mechanical reinforcement applications, and can be added to the lightweight metals, such as Aluminum and Magnesium to improve their mechanical properties. Mechanical properties of reinforced metals are heavily influenced by interfacial reactions between the metal and the nanotubes. In this study, Magnesium alloy (AZ31) is reinforced with BNNT through spark plasma sintering (SPS). The composite is processed at 400 °C, which can induce chemical reactions between the alloy and the nanotubes. The focus is to understand the reactivity at interface within the composite, in SPS conditions. To accomplish this, Transmission Electron Microscope (TEM) images of the alloy-nanotube interface are captured. High-resolution TEM images reveal the atomic planes in the microstructure. Inter-atomic spacing (d-spacing values) are determined from different regions in the TEM micrographs using image analysis and selected area diffraction (SAED) techniques. The phases associated with the computed d-spacings are identified using International Center for Diffraction Data (ICDD) database. It is observed that Aluminum Nitride, Aluminum Boride and Magnesium Nitride are the principle reaction products formed during spark plasma sintering of AZ31-BNNT composite. Other testing methods, such as X-ray Diffraction (XRD) will be conducted to corroborate these results. The findings of this work are relevant from the standpoint of synthesizing BNNT-reinforced advanced composites with known microstructures.