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# Synthesis of Al-Ti-B Master Alloy by SHS Method and Investigation of the Effect of Master Alloy Produced on Grain Size and Hardness of Aluminum Alloy

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**Abstract:** In this study Al-Ti-B master alloy was produced by self-propagation high temperature synthesis (SHS) from elemental powder compacts. The heat required to initiate reactions in the SHS process was provided by electrical arc. The elemental powders were mixed together to form final master alloys containing about 20, 25 and 30 mole % TiB2. X-ray diffraction analysis (XRD) was used to identify the phases formed in the master alloy and the resulted alloy. The master alloys mainly consist of TiAl, Ti3Al and TiB2 phases. Scanning electron microscopy (SEM) was used to observe the morphology of the second phase particles in the master alloy. TiB2 particles morphology was hexagonal and tetragonal. TiB2 particles were agglomerated and formed clusters. Also, needle like morphology was observed for TiB2 particles. The amount of 0.2 wt % of master alloys was added to aluminum alloy. Optical microscopy (OM) was used to observe the microstructure of the alloy. Optical microscopy images were analyzed using Clemex Vision software to determine the ASTM grain size number (G) of the alloy with and without master alloy, as well as the estimated percent of intermetallic compounds. The highest G (13.39) was found in the reference alloy and the lowest G (12.36) was found in the alloy containing 30% TiB2. Energy dispersive x-ray spectroscopy (EDS) was used to determine the chemical composition of the intermetallic compounds formed in the aluminum alloy. The hardness of the alloy increased and then decreased with increasing TiB2. The hardness of the specimen containing master alloy with 25 mole % TiB2 (97.64HV0.05) was higher than that of other specimens.

**Keywords (11 Bold):** "Al-Ti-B Master Alloy"; "SHS"; "Electrical arc"; "Aluminum Alloy"