

Mechanical Properties of Spark Plasma Sintered 2024 AA Reinforced with TiB₂ and Nano Yttrium

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Abstract : The main advantages of 'Metal Matrix Nano Composites (MMNCs)' include excellent mechanical performance, good wear resistance, low creep rate, etc. The method of fabrication of MMNCs is quite a challenge, which includes processing techniques like Spark Plasma Sintering (SPS), etc. The objective of the present work is to fabricate aluminum based MMNCs with the addition of small amounts of yttrium using Spark Plasma Sintering and to evaluate their mechanical and microstructure properties. Samples of 2024 AA with yttrium ranging from 0.1% to 0.5 wt% keeping 1 wt% TiB₂ constant are fabricated by Spark Plasma Sintering (SPS). The mechanical property like hardness is determined using Vickers hardness testing machine. The metallurgical characterization of the samples is evaluated by Optical Microscopy (OM), Field Emission Scanning Electron Microscopy (FE-SEM) and X-Ray Diffraction (XRD). Unreinforced 2024 AA sample is also fabricated as a benchmark to compare its properties with that of the composite developed. It is found that the yttrium addition increases the above-mentioned properties to some extent and then decreases gradually when yttrium wt% increases beyond a point between 0.3 and 0.4 wt%. High density is achieved in the samples fabricated by spark plasma sintering when compared to any other fabrication route, and uniform distribution of yttrium is observed.

Keywords : spark plasma sintering, 2024 AA, yttrium addition, microstructure characterization, mechanical properties

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