

# Microstructural Refinement and Enhancement of Mechanical properties of Al (2014) – SiC Composites by Equal Channel Angular Pressing

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## Abstract

The major aim of this work is to prepare a metal matrix composite that combines the high tensile properties of materials like 2014 Aluminium alloy (base metal) with the high strength materials like Silicon Carbide (reinforcement) within an optimum cost limit. There is a need to refine and enhance the properties of composites fabricated by primary processing methods such as Stir Casting. Equal Channel Angular pressing (ECAP) is a proven Secondary Processing method for grain refinement. ECAP refines the grain size of the composites, leading to higher strength as grain is refined down to sub-micron level. Initially SiC is coated with Nickel in order to increase its wettability. The Aluminium composites are fabricated by Stir Casting process with 5 %, 10 % and 15 % SiC respectively. Then the composites are subjected to ECAP using die with 120° angular channel. The Stir Cast and ECAPed samples are tested and compared for tensile, flexural, impact and hardness properties. Results reveal that the mechanical properties are improved when the composites are subjected to ECAP. The microstructure is analysed using Optical Microscope and grain size is found to be reduced in ECAPed samples. Using Scanning Electron Microscope and Energy Dispersive X- Rays, fractured surface is analysed. The composite samples with Al (2014) - 15 % Nickel coated SiC have higher Tensile Strength, Flexural Break Load, Impact Strength and Hardness followed by Al (2014) - 10 % Nickel coated SiC, Al (2014) - 5 % Nickel coated SiC and Al (2014). Also it is observed that the percentage elongation of the Stir Cast samples reduces when subjected to ECAP as the yield strength of ECAPed sample is higher than Stir Cast samples.

**Keywords:** 2014 Aluminium alloy, Silicon Carbide, Nickel Coating, Stir Casting, ECAP, Mechanical Properties, Microstructure, Fractograph