Mechanical Characterization of AA2024-Graphite Microcomposites

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ABSTRACT

Aluminum-based particulate metal matrix composites have fascinated due to their desirable properties. Al composites are used for helicopter parts in aeronautics, rotor vanes in compressors, etc. A low wear resistance of pure aluminum is a serious negative aspect. An addition of a non-metallic second phase such as oxides, carbides, nitrides and borides to aluminum alloys can significantly improve the mechanical properties and wear resistance of the materials. Particle reinforcements are more constructive than the fiber type as they allow a better control of the microstructure and mechanical properties obtained by varying the size and the volume fraction of the reinforcement. Solid lubricants are used for applications in which sliding contact occurs to reduce the friction. Solid lubricant provides protection from damage during relative movement between the sliding elements to reduce the friction and wear. In many papers, it was reported that graphite particulates form a solid lubricant on a tribosurface. Graphite particle has a brittle structure. The tendency of crack initiation and propagation increases at the graphite-metal interface in the composites.

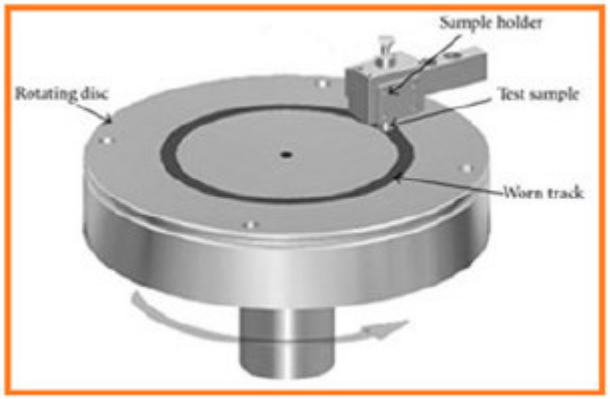

Figure 1: Tests carried out in the present work: (a) Pin-on-disc wear test and (b) Surface roughness test.

In the current work, dry sliding wear of AA2024 alloy-graphite composites with different particle sizes were studied under different combinations of sliding speed, normal load, sliding distance and particle size based on Taguchi techniques. Scanning electronic microscopy (SEM) was employed to study the microstructure of composites and the morphology of the worn surfaces of the composites.

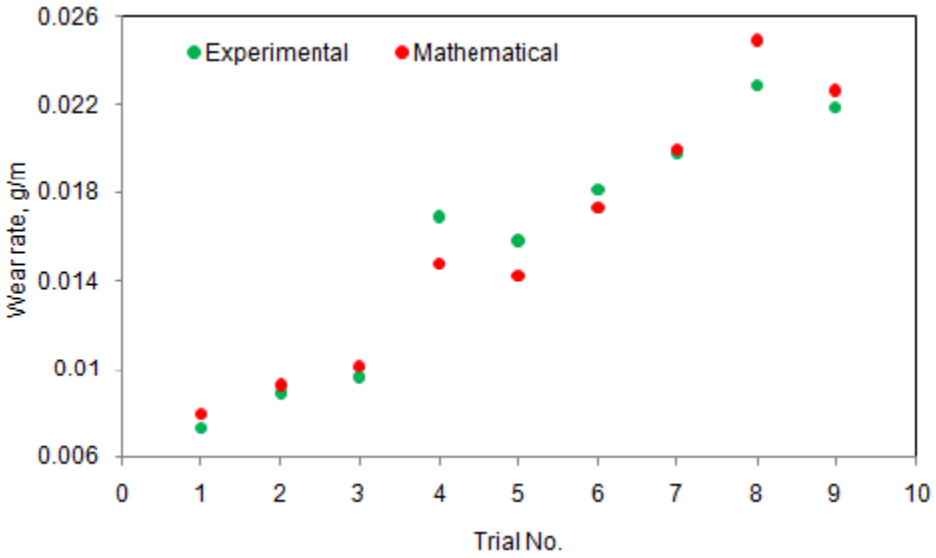

Figure 2: Validation of mathematical modeling with experimental results.

The effect of micro-size particles on the severity of wear was inventively modeled and validated with experimental results of AA2024 alloy-graphite composites. The AA2024 alloy-graphite composites have experienced severe wear due to macro particle damage during wear tests.

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