Sliding Wear Behavior of Boron Nitride Reinforced AA6061 Metal Matrix Composites

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ABSTRACT

In the past few years, the demand for lighter weight materials with increased specific strength for the automotive and aerospace industries has caused the development and usage of aluminum alloy based composites. Aluminum metal matrix composites reinforced with ceramic particles are gaining wide popularity as high performance material because of their improved strength, high elastic modulus and increased wear resistance, their ability to exhibit superior strength-to-weight and strength-to-cost ratio over conventional base alloy. Al alloy based metal matrix composites are presently used in several applications such as pistons, pushrods, cylinder liners and brake discs. Metal composite self-lubricating composites are among the materials that are currently of great scientific interest. Self-lubricating composites have also been developed for engineering applications, including gears, bearings, bushings and cams. Erosive and abrasive wear may both be viewed as surface damage resulting from the relative motion with another body. Where the two forms of wear diverge involves the nature of the relative motion. Numerous reports are available on the subject of the fabrication and wear studies of the metal matrix composites. Ceramic materials TiO_2, graphite, carbon, ZrO_2, TiN, B4C, ZrC, Si_3N_4 and SiO_2 provide wear resistance and mechanical strength.

The aim of this project work was to model the effect of boron nitride (BN) particle size on the sliding wear of AA6061-BN composites. For this purpose AA6061-BN metal matrix composites were manufactured with particle size varying from 100µm to 200µm. Dry sliding wear of AA6061 alloy-BN composites with different particle sizes were studied under different combinations of sliding speed, normal load, sliding distance and particle size based on Taguchi techniques.

The impact of micro-size particles on the severity of wear was modeled and validated with experimental results of AA6061 alloy-BN composites. The ploughing of particles due to wear and hard asperities were observed on the surfaces of 200µm particle reinforced composites.

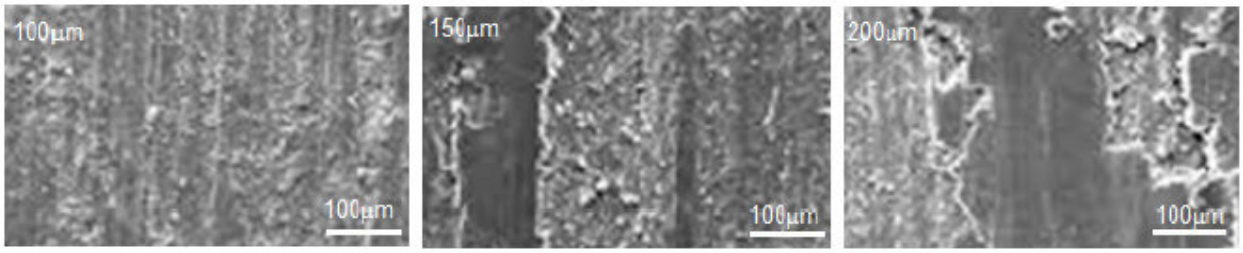

Figure 1: Micrographs of worn surfaces.

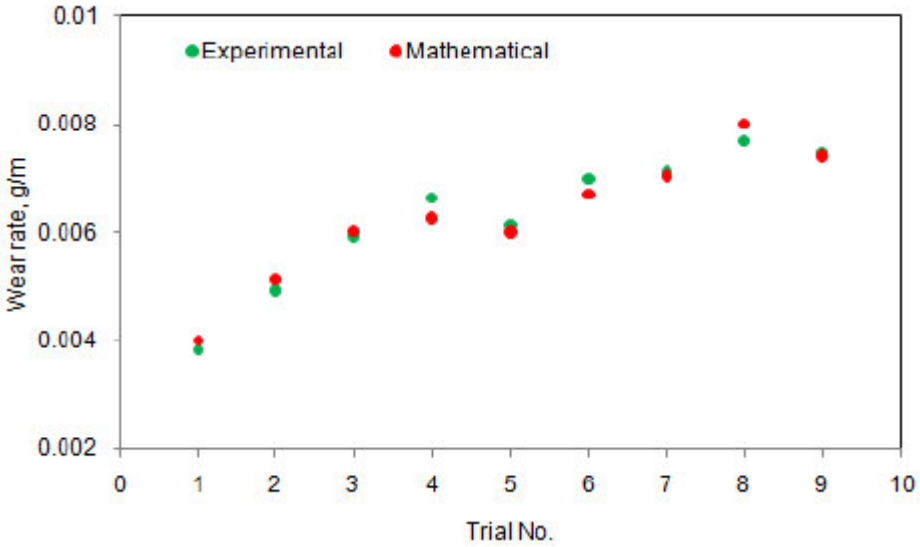

Figure 2: Validation of mathematical modeling with experimental results.

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