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Wear behavior of epoxy resin reinforced with ceramic nano- and microparticles

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Abstract-

Cavitation erosion poses a significant challenge in fluid systems like hydraulic turbines and ship propellers due to pulsed pressure from collapsing vapor bubbles. To combat this, various materials and surface engineering methods are employed. In this study, nano and micro scale particles of silicon carbide (SiC) or boron carbide (B4C) were incorporated as reinforcement at 6% and 12% ratios, owing to their exceptional resistance to abrasive wear and high hardness. Microparticles were incorporated to assess the damage incurred during the tests in comparison to nanoparticles. Wear tests were conducted on both bulk samples and coated aluminum sheets with a 1mm of composite. Additionally, cavitation tests were performed on coated aluminum tips until stability of mass loss was achieved. The results indicated a distinct wear behavior between the coatings and the bulk samples. Overall, wear tended to be higher for the coated samples with nanocomposites than bulk, except for the nano-composite material containing 12% SiC and pure resin. With the coatings, higher percentages of nanometric particles correlated with increased wear. The coefficient of friction remained within the range of 0.4 to 0.5 for the coatings. Regarding the accumulated erosion in the cavitation tests for 100 min, it was observed that for all nanocomposite materials, it was lower than in pure resin. Particularly, the composite with 6% B4C was slightly lower than the rest. In addition, the erosion rate was also lower for the composites.

Index Terms- cavitation erosion; wear; nanoparticles; silicon carbide; boron carbide; coating; nanocomposites; epoxy resin

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