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Evaluation of Wear Properties of Heat-Treated Al-AlB2 in-situ Metal Matrix Composites

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Abstract

Considerable improvement in weight reduction, strength, wear obstruction, and modulus is the basic in meeting the plan and design criteria for the production of airplane, launch vehicles, and automobiles. This work proposes the low-cost manufacture process involving 2, 4, and 6 wt% AlB2 in-situ particle strengthened with aluminum (Al) Metal Matrix Composites (MMCs) utilizing chemical reaction through exothermic response between halide salt KBF4 and Al matrix at a temperature of 850 °C through vortex technique. The as-cast matrix blend and the in-situ composite were heat treated at a temperature of 535 °C for 1 h accompanied by quenching in various media like ice, oil, and water. The quenched samples were subjected to artificial aging at a temperature of 175 °C for 10 h. Microstructural studies were conducted on the as-cast and in-situ composites for dissemination of AlB2 particles in the as-cast matrix. SEM images affirm the development of AlB2 with uniform circulation in the matrix. X-ray diffractometer test was performed for the formation of AlB2 reinforcement phase in the matrix composite. Wear and mechanical properties were explored for the in-situ composites; for wear test, the impact of sliding rate, applied load, and sliding distance were basic parameters corresponding to the wear experienced by the material. The wear conduct and worn morphology of the aluminum MMCs subjected to various quenchants were additionally evaluated using pin-on-disc tests involving specimens to slide against a hardened steel disc under different load conditions. The exploratory outcomes exhibited that the typical load and fortification proportions were significant variables affecting the volumetric wear rate for all the quenched samples, trailed by sliding speed. The wear resistance behavior is found to be higher for specimens involving ice quenching treatment followed by water and oil-quenched composites.

Keywords:
AlB_2, in-situ, Halide salt, AMMC, Stir casting

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