ABSTRACT

Aluminium Metal Matrix Composites (AMMCs) are nowadays well-acknowledged engineering materials that have been widely used in the automotive and aerospace industries mainly due to their better mechanical properties, such as light weight, high strength-to-weight ratio, etc. In this study, a metal matrix composite is fabricated in which, aluminium 6063 is chosen as the base matrix and boron carbide (B_4C) is chosen as a reinforcement because of its extreme hardness properties. Basalt fibre is also chosen as a reinforcement because of its superior thermal stability, excellent tensile strength, and high modulus of elasticity. In this study, the stir casting technique is used to fabricate the composite material. In our present investigation, mechanical and tribological properties such as hardness, tensile strength, impact strength, and wear resistance are analysed for composite materials with three different amounts of reinforcement: 0%, 4% (2% B_4C and 2% Basalt fibre), and 8% (4% B_4C and 4% Basalt fibre). The wear resistance characteristics of the MMC are investigated by performing a dry sliding wear test using a pin-on-disc apparatus. The test results show that the hardness, tensile strength, and impact strength of the MMCs with 4% reinforcements are about 41.46%, 11.62%, and 166.67%, respectively, better than for Al6063, and the MMCs with 8% reinforcement are about 53.65%, 23.35%, and 188.88%, respectively, better than for Al6063. The wear test results are analysed using the Taguchi approach, and the most influencing parameters are found as reinforcement%, sliding speed, load applied, and sliding time from highest to lowest. Using regression analysis, the optimum wear test parameters are found to be 8% reinforcement, 300 N of load, 600 rpm of sliding speed, and 9 minutes of sliding time, with a predicted wear rate of 0.0023278 mm3/m. From this investigation, it is evident that the mechanical and tribological properties of the Al6063 alloy are increased while adding the B_4C and basalt fibre reinforcement particles.