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Effect of heat treatment on microstructure and tribological behavior of friction stir processed Al2O3-reinforced AA2024-T351 matrix

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Abstract: In the present work, 2024-T351 Al alloy reinforced with alumina particulates (Al2O3p) was elaborated using friction stir processing (FSP). The effect of solution heat treatment followed by subsequent aging on microstructure, hardness, and tribological behavior is discussed. It was noticed that the hardness of the as-FSPed 2024-T351/Al2O3p was slightly enhanced in comparison to the as-received AA2024-T351 material, whereas the resulting wear resistance was remarkably improved. After heat treatment process, the composite volume increased, and swelling and pores were created at the processed area. The heat treatment caused a degradation in wear resistance compared to as-FSPed composites. The precipitation mechanism changed forAA2024/Al2O3p; reactions occurred at grain boundaries between Al2O3 and Cu or Mg, causing their depletion from the Al matrix. Intriguingly, the precipitation mode in heat-affected zone of the matrix also changed to grain boundary precipitation.

Keywords : Friction stir processing, Metalmatrix composites, wear, friction