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Topic of Research: Surface Hardening using Hybrid FSP

FINDING

The present study was performed to reveal the effect of FSP parameters on microhardness. A mixture of silicon carbide (SiC) powder of particle size 400 µm and Ti powder of particle size of 70 nm in the ratio of 3:10 was used as reinforcement for fabrication of AA5083 surface composites (SCs). Further, Hybrid FSP (normal FSP followed by gas tungsten arc welding (GTAW) was performed to enhance the microhardness of FSP processed SCs. The S/N ratio was measured corresponding to response values obtained from experimental results. The higher the better quality characteristics were utilized. ANOVA was performed to determine the significance of each process parameter, the significance of the model, predict the percentage contribution of all parameters, and the percentage contribution of error.

Optimal combination of FSP parameters corresponding to the maximum value of microhardness is $A_1B_1C_3$ i.e., tool shoulder diameter (A) at 17 mm, tool rotational speed (B) at 355 rpm and tool traverse speed (C) at 100 mm/min as it yielded the maximum microhardness. The interaction A*C has highest impact on microhardness having percentage contribution of 37.34 %, followed by interaction B*C (29.46 %), C (10.25 %), interaction A*B (9.26 %), B (3.65 %) and A (1.20 %), respectively. The two SC specimens fabricated via FSP having maximum (S3) and minimum (S14) microhardness were selected and were followed by GTAW to study the influence of hybrid FSP on microhardness. From experimental results a significant increase in microhardness was observed by hybrid FSP. The effect of weld bead geometry on microhardness values was measured in terms of width to depth ratio of SZ of FSPed and hybrid FSPed specimens. A higher hardness value was observed in specimens having lowest width to depth ratio.

Keywords: Friction stir processing, Hybrid FSP, AA5083, Surface composite, Microhardness