

Surface Roughness of Laser Modified Die Surface Change Under Thermal Cyclic Loading

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ABSTRACT

Thermal fatigue crack results in decrease of die service life has brought to a significant loss in the die casting industry due to the high cost of die. Laser surface modification is proposed in this study to enhance the surface properties of die and increase the resistance of thermal crack. In this study, the changes of surface roughness of laser modified die surface were investigated during thermal cyclic loading. H13 tool steel samples were sectioned while the surface of the samples were laser modified at different parameters. Laser modified samples were subjected to thermal cyclic loading by continuously heating in molten aluminium and cooling in water bath at respective temperature range of 850–900 °C and 27 °C. The results of surface roughness and morphology were obtained using a display optical microscope after 3000, 4000 and 5000 cycles of thermal cyclic loading. The surface roughness of laser modified tool steel with hardness properties of 745 HV experienced the least changes throughout the thermal cyclic loading process. The minimal changes of surface roughness on the laser modified die reduces the formation of the oxide layer and thus reduces the thermal fatigue of die casting dies.

KEYWORDS

Die casting; Surface roughness; Thermal crack

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