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Laser Melting of High Thermal Conductivity Steel (HTCS) Surface

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Abstract. This paper presents a laser melting of high thermal conductivity steel (HTCS) dies for surface properties modification due to die failures during operations. Sample were cut from as-received die without any defect or crack. Melting process was conducted using Nd:YAG laser system with pulse mode at 50 W average power. The laser beam was defocused to a spot size of 1 mm on the sample surface. Parameters controlled in this study were peak power of 800 and 1200 W, and pulse repetition frequency of 80 and 90 Hz. Metallographic study and chemical composition analysis were conducted using Hitachi TM3030Plus scanning electron microscope (SEM) and energy dispersive x-ray spectrometer (EDXS). Surface roughness was measured using Mitutoyo SURFTEST SJ-410 stylus profilometer. Hardness properties of the modified layer were characterized by Wilson Hardness tester at 100 N force. The metallographic study showed high porosity at partially melted zone (PMZ) area. From overall findings, laser processing parameter affected hardness properties and surface roughness of modified layer. Where the surface roughness value obtained is between 1.49 and 3.15 μm, while the hardness value is between 550.9 and 610.9 $HV_{0.1}$. These findings are significant to parameters selection for hot stamping die surface repair and prolong its service.