Effect of Laser Surface Modification (LSM) on Laser Energy Absorption for Laser Brazing

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Abstract:
Since the development of the laser in the 1960s a rapid development of research interests in science and technology took place. Since then, the need of laser application in industrials such as automotive, aerospace and electronics is increasing because of several advantages like automation worthiness, noncontact processing and product quality improvement. In this present study, the effect of Laser Surface Modification (LSM) on pure copper plate towards the laser energy absorption during indirect laser brazing process was studied. The laser brazing experiment was conducted inside a chamber under controlled vacuum pressure with 400Pa and irradiated with constant 140Watt laser power. The defocusing features for laser brazing was used in order to find better focal position. Accordingly, the focal length for this laser brazing experiment was set to the focus point at 124 mm from the focal plane. Meanwhile, during LSM process, laser parameters such as laser speed and focus length has been kept constant throughout the surface modification process. Yet, the laser power and laser frequency have been varied from 9Watt to 27Watt and 10kHz to 80kHz respectively. Apparently, surface ablation and oxide layer formation were presented during LSM process. These two surface integrities were found to be the factors of increasing laser energy absorption. It was discovered that an increase in surface roughness and oxide layer formation are able to absorb more laser energy which then results an increase in brazing temperature during laser brazing. This is because, increasing surface roughness will scatter the laser energy over a larger surface area, multiply the reflections in the surface irregularities and the oxide layer will enhance the interference phenomena of laser energy occurring inside the oxide layer. Both mechanisms increase laser energy absorptivity during laser brazing which results a high brazing temperature.

Keywords : Laser Brazing; Laser Energy Absorption; Laser Surface Modification; Oxidation Layer; Surface Roughness
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