Nd:YAG laser welding of stainless steel 304 for photonics device packaging

Abstract:

Although pulsed Nd:YAG laser welding has been widely used in microelectronics and photonics packaging industry, a full understanding of various phenomena involved is still a matter of trials and speculations. In this research, an ultra compact pulsed Nd:YAG laser with wavelength of 1.064 μm has been used to produce a spot weld on stainless steel 304. The principal objective of this research is to examine the effects of laser welding parameters such as laser beam peak powers, pulse durations, incident angles, focus point positions and number of shots on the weld dimensions: penetration depth and bead width. The ratio of the penetration depth to the bead width is considered as one of the most critical parameters to determine the weld quality. It is found that the penetration depth and bead width increase when the laser beam peak power, pulse duration and number of shot increase. In contrast, the penetration depth decreases when the laser beam defocus position and incident angle increase. This is due to the reduction of the laser beam intensity causing by the widening of the laser spot size. These experimental results provide a reference on an optimal laser welding operations for a reliable photonics device packaging. The results obtained shows that stainless steel 304 is suitable to be used as a base material for photonics device packaging employing Nd:YAG laser welding technique.