G11.K1

A CO_2 Laser Welding of Plastics Assisted by a Solid Heat Sink without Causing Thermal Damage

*Yasuo Kurosaki (a), Tomoya Matayoshi (b), Kimitoshi Sato (c)

(a) *Cooperative Research Center, University of Electro-Communications, Chofu, Japan*
(b) *Electronic & Engineering Materials Laboratory, Mitsui Chemicals Inc.,Chiba, Japan*
(b) *Department of Mechanical System Engineering, Hiroshima Institute of Technology, Japan*

Joining plastics by using a diode laser is now popular in car and micro-scale manufacturing. In the procedure, it is essential that the plastic irradiated by the laser is transparent and the other side of plastics must be opaque to the laser beam. So far both of transparent plastics such as polyolefin and PMMA are unable to be welded by the diode laser. Joining of the same kinds of plastics without thermal damage on the irradiated surface of plastics is strongly required in industry; particularly medical appliance and telecommunication technology fields. This paper delivers an introduction of a novel CO_2 laser plastic welding procedure developed from the point of view of heat transfer. The principle of the current procedure assisted by a solid heat sink transparent to CO_2 laser beam placed on the irradiated surface of plastics is explained. The current welding technique is developed with combination of infrared radiation absorbing heating and thermal diffusion cooling processes in plastics. A solid material transparent to CO_2 laser beam and with a high thermal diffusivity is applied as a heat sink in contact with irradiated surface of overlapped thermoplastics during radiation heating. The feasibility of the current CO_2 welding is confirmed by both experiment and numerical simulations. The welding technique is able to achieve both high weld strength and excellent surface appearance without causing surface thermal damage as often suffered in conventional direct infrared radiation welding process without a solid heat sink. In addition, pigmentation in welding material to increase absorption of radiation is unnecessary for this method and is unfavorable in terms of biological safety for most medical and food industry.