Abstract

The cutting capabilities of CW, Sine, and Square waveforms from a Lumonics MW500 Nd:YAG laser were investigated and compared. The ranking for them in the cutting of carbon steels and stainless steels was found to be (CW > Sine > Square). Empirical formulas for cutting were obtained. In laser cladding, Ni-Cr-B-Si (Ni25) powder was pre-placed onto samples (45 steels) by flame-spraying and then they were treated by an Nd:YAG laser. Through SEM and X-ray diffractometry analyses, the mechanism behind strengthening after laser treatment was found to be due to grain-size reduction. In laser transformation hardening, carbon steels were used. Typical appearance of a hardened track was observed with an optical microscope. In both kinds of surface treatments, the relationships between hardness and laser power/scan speed were obtained. Increase in hardness was directly proportional to scan speed for a fixed laser power. A simple model for estimating the micro-hardness of a hardened track was proposed. In both cutting and surface treatment, mathematical models from other researchers were included for discussions of the primary parameters affecting both processes and validation of experimental data. Finally, an effort in combining the laser machine in the Laser Processing Laboratory and the machining centre in the CAD/CAM Laboratory as a hybrid LOM system was made. It was concluded that the processing time spent on the machining centre could be saved.