Light for Advanced Manufacturing

SYNOPSIS

Manufacturing capability is one important indicator of the strength of one Nation. The cost, speed and quality of the products from the manufacturing lines are closely related to every aspect of our life. Now we are moving into the time of the internet. Big data, internet of things, artificial intelligence, and many other emerging concepts define the new challenges for our modern manufacturing to achieve higher accuracy, higher efficiency and higher productivity. Advanced manufacturing is the new strategy leading to the feasible solutions.

Light plays a key role on the advanced manufacturing. Being as fast as light, it provides the maximum speed allowed for rapid optical sensing and data commination. Being as accurate as light, it offers the reliable means to fabricate current digital devices in micro- even nano-scale. Being as colourful as light, it serves as the basis for optical imaging and materials real-time characterization. The unique properties of light are achieving varieties of innovations and bringing about plenty of new opportunities. In this lecture, the beauty of light will be highlighted in both the scopes of high-power applications, such as laser micro-processing and nano-fabrication for thin wafer processing in production lines, femtosecond laser precision engineering of man-made bio-skins for tissue engineering, lotus-leave-like super-hydrophobic structures and metamaterials fabrication; as well as low-power applications, including optical nano-imaging and laser diagnostics of cracks inside steel structures and gas leakage detection. Laser cleaning of surface contaminations, Laser color marking of metal surfaces, Portable Raman spectroscope, and Optical microsphere nanoscope being developed in our laboratory will be case studied to emphasize the importance of technology commercialization for our new industries. (272 words)