Femtosecond and Nanosecond Laser Micromachining of Oxidized Multi-Wall Carbon Nanotube Doped Morthane

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Abstract

Carbon nanocomposites consist of thermoset and thermoplastic materials filled with carbon nano-particles (nanotubes, bucky balls, etc.). This innovative group of materials offers many advantages over standard polymers such as electrical/thermal conductivity and improved structural properties. In the current study, an Yb:KGW solid-state femtosecond laser and an Nd:YVO solid-state nanosecond laser were used to micromachine oxidized multi-wall carbon nanotube (MWCNT) doped morthane. The experimentation studied the relationship between various laser-processing parameters including laser pulse duration, pulse energy, beam scanning speed, and average power. The processing consisted of cutting channels into the materials using 1048 nm wavelength at 400 fs pulse duration, 1064 nm wavelength at 40 ns pulse duration, and 355 nm wavelength at 35 ns pulse duration. Additionally, the effects of oxidized WCNT fill percentage were considered. The material removal rate was quantified for each experimental condition. The experimental results are discussed in terms of material removal rates, machining quality, and achievable feature size.

Keywords: carbon nanocomposites, femtosecond, Yb:KGW, Nd:YVO , micromachining

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