Abstract Submitted
for the OSS05 Meeting of
The American Physical Society

Laser Interaction, Micromachining and Precision Joining of Carbon Nanocomposites LARRY DOSSER, KEN HIX, KEVIN HARTKE, Mound Laser & Photonics Center, Inc., MAX ALEXANDER, BRANDON BLACK, Air Force Research Lab, AIR FORCE RESEARCH LAB TEAM, MOUND LASER & PHOTONICS CENTER, INC. TEAM — Carbon nanocomposites consist of thermoset and thermoplastic materials filled with carbon nano-particles such as nanofibers, nanotubes, and Bucky Balls. This new and innovative group of materials offers many advantages over standard polymers such as electrical/thermal conductivity and improved structural properties. The presence of carbon nano-particles introduces unique advantages to the laser micromachining and microjoining processes. These advantageous include strong optical absorption at the laser wavelengths of interest and improved thermal stability during the laser processing. As a result, carbon nanocomposites exhibit superior laser processing properties when compared to conventional unfilled thermoset and thermoplastic materials. In the current study, Nd:YAG and Nd:YVO4 solid-state lasers were used to micromachine several carbon nanocomposite, thermoplastic, and thermoset materials. In addition, direct diode and Nd:YAG solid-state lasers were used to transmission weld carbon nanocomposites and carbon black filled polymers. The effects of nano-particle type, nano-particle fill percentage, and polymer type on the laser micromachining and laser welding processes are discussed.

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Date submitted: 21 Mar 2005 Electronic form version 1.4