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Laser Shock Wave Assisted Patterning on NiTi Shape Memory Alloy Surfaces[1] BYRON GRANT, DOVLETGELDI SEYITLIYEV, KHOMIDKHODZA KHOLIKOV, western kentucky university, HALUK KARACA, PEIZHEN LI, University of Kentucky, ALI ER, western kentucky university, WKU/UK COLLABORATION, UK TEAM — Shape memory alloys are a unique class of smart materials that have become of recent interest in engineering, biomedical and aerospace technologies. We report an advanced direct imprinting method with low cost, quick, and low environmental impact to create thermally controllable surface pattern using laser pulses. Patterned micro indents were generated on NiTi SMAs using an Nd:YAG laser operating at 1064 nm combined with suitable transparent overlay, a sacrificial layer of graphite, and copper grid. Laser pulses at different energy densities generating pressure pulses up to 10 GPa on the surface was focused through the confinement medium, ablating the copper grid to create plasma and transferring the grid pattern onto the NiTi surface. AFM, SEM and optical microscope images of square pattern with different sizes were obtained. One dimensional profile analysis show that depth of the pattern initially increased linearly until the optical breakdown of the transparent overlay occurs and dense ionized plasma absorbs and reflects the laser beam. Experimental data is in good agreement with theoretical simulation of laser induced shock wave propagation inside material. Rapid attenuation and dispersion of stress wave was observed.

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