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Optical properties during elastic-plastic transition in $Gd_3Ga_5O_{12}$ single crystals under shock compression X. ZHOU, National Key Lab. of Shock Wave and Detonation Physics, W.J. NELLIS, Harvard U, JUN LI, JIABO LI, X. LIU, X. CAO, X. WANG, H. HE, W. ZHU, Q. WU, National Key Lab. of Shock Wave and Detonation Physics — Planar impact experiments were performed to investigate optical changes in high-impedance GGG single crystals during the elastic-plastic transition. Time-resolved radiance and transmission spectra were measured with a multi-wavelength pyrometer. Simultaneously, velocity profiles were diagnosed at the impact and free surfaces with a Doppler Pin System (similar to PDV). Findings include (1) pressure-dependent yielding in GGG with the HEL increasing from 7.65 to 24.2 GPa as final pressure increases from 8.52 to 88.5 GPa, (2) a unique feature of optical transparency lasts for some time, which is associated with elastic-stress relaxation and attributed to molecular bond breaking, (3) decay in spectral radiances emitted from plastically deformed GGG, based on which we propose a new model that takes light absorption and scattering into account. Our model reproduces observed radiance histories quite well. Initial transparency during the elastic process was verified by the optical transmission measurements at relevant low shock pressures (<62 GPa).

X. Zhou
National Key Lab. of Shock Wave and Detonation Physics

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