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Optical emission from $Gd_3Ga_5O_{12}$ single crystals shock compressed from 40 to 300 GPa XIANMING ZHOU, National Key Laboratory of Shock Wave and Detonation Physics, Institute of Fluid Physics, China, WILLIAMS NELLIS, Physics Department, Harvard University, JIABO LI, JUN LI, XUN LIU, XIUXIA CAO, WANGUANG ZHAO, QIANG WU, National Key Laboratory of Shock Wave and Detonation Physics, Institute of Fluid Physics, China, TSUTOMU MASHIMO, Shock Wave and Condensed Matter Research Center, Kumamoto University, CAEP, PR CHINA TEAM, HARVARD UNIVERSITY COLLABORATION, KUMAMOTO UNIVERSITY COLLABORATION — The question of the shock pressure at which a strong material reaches thermal equilibrium is an important one that depends on strength and has never been answered for any strong material. To answer the range of shock pressures in which shock dissipation is dominated by entropy (damage and disorder) or by shock heating (T), we have performed time-resolved optical emission and transmission measurements on strong GGG single crystals under wide-range uniaxial compression from ~40 GPa to ~300 GPa with a sixteen-wavelength pyrometer. Temperatures T and emissivities e were derived from gray-body fits up to 300 GPa. These data: (i) determine shock pressures at which GGG reaches thermal equilibrium and melting, (ii) essentially confirm previously calculated shock temperatures of GGG, (iii) demonstrate the complete transition from heterogeneous shock heating at lower pressures (small e) to thermally-equilibrated bulk heating (large e) at higher pressure (never before been done in strong materials), and (iv) characterize GGG as an anvil for use in studying metallic fluid hydrogen.

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