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Microscale In-situ High-speed Imaging of Temperature and Deformation Fields AMIRREZA KEYHANI, YANG RONG, MIN ZHOU, The George W. Woodruff School of Mechanical Engineering, Georgia Institute of Technology, Atlanta, GA 30332-0405, USA — A novel capability (MINTED, or microscale in-situ imaging of temperature and deformation fields under dynamic loading) for time-resolved and space-resolved measurements of the temperature and deformation fields at the microstructure level for dynamic conditions is developed. The system cohesively integrates a state-of-the-art high-speed infrared (IR) camera and a high-speed visible light (VL) camera in a Kolsky bar apparatus. To simultaneously capture deformation and temperature fields at normal incidence with joint microsecond time and micrometer scale spatial resolutions, the VL and IR emissions from the sample are separated by a dichroic beam splitter. The beam splitter reflects visible spectrum into the VL camera and transmits the IR spectrum into the IR camera. This is a general capability that can be used to study deformation, failure and heating in materials. To demonstrate the capabilities of the MINTED system, experiments were performed on sucrose granules, which are widely used as a simulant of energetic crystals. The deformation and temperature fields provide detailed first-time insight into the processes of fracture, friction, shear localization, and hotspot development in the microstructures.

Amirreza Keyhani
The George W. Woodruff School of Mech. Eng. Georgia Institute of Tech.

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