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Defect substructures in laser shocked and plate impacted monocrystalline copper BU YANG CAO, MARC A. MEYERS, Mat. Sci and Eng. Program, University of California, San Diego, DAVID H. LASSILA, LLNL, MATT S. SCHNEIDER, Mat. Sci and Eng. Program, University of California, San Diego, YONG BO XU, Chinese Academy of Sciences, Shenyang Natl. Lab. for Matls. Sci., Inst. of Metal, China, DANIEL H. KALANTAR, BRUCE A. REMINGTON, LLNL — Monocrystalline copper samples with orientations of [001] and [221] were shocked at pressures ranging from 20 GPa to 60 GPa using two techniques: direct drive lasers and explosively driven flyer plates. The pulse duration for these techniques differed substantially: 2 ns for the laser experiments and 1.1—1.4 us for the flyer-plate experiments. The residual microstructures were dependent on orientation, pressure, and shocking method. The much shorter pulse duration in laser shock yielded recovery microstructures with no or limited dislocation motion. For the flyer-plate experiments, the longer pulse duration allow shock-generated defects to reorganize into lower energy configurations. Calculations show that the post shock cooling occurs in a time scale of 0.2 s for laser shock and 1000 s for plate-impact shock, propitiating recovery and recrystallization conditions for the latter. At the higher pressure level extensive recrystallization was observed in the plate-impact samples, while it was absent in laser shock. An effect that is proposed to contribute significantly to the formation of recrystallized regions is the existence of micro-shearbands, which increase the local temperature.

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