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High-Strain Rate Response of Ultra-Fine Grained Copper: Experiments and Analysis A. MISHRA, Dept. of Mechanical and Aerospace Engineering and Materials Science Program, University of California, San Diego, M. MARTIN, N.N. THADHANI, School of Materials Science and Engineering, Georgia Institute of Technology, B. KAD, Dept. of Structural Engineering, University of California, San Diego, M.A. MEYERS, Dept. of Mechanical and Aerospace Engineering and Materials Science Program, University of California, San Diego — Equal Channel Angular Pressing (ECAP) is a severe plastic deformation technique that was used to produce ultra-fine grained copper. The microstructure was optimized using different deformation sequences. A steady state grain size of 200-500 nm was routinely obtained after eight passes (with an effective strain of $\sim$1 per pass). This resulted in a random texture evidenced by EBSD results. The mechanical response was obtained under quasi-static and dynamic conditions. The ultra-fine grained structure produced in Cu by ECAP was found to be thermally unstable. The microstructure recrystallized upon being dynamically deformed due to the adiabatic temperature rise imparted by plastic deformation. This was observed in three modes of high-strain rate plastic deformation experiments: cylindrical and hat-shaped specimens in Hopkinson bar experiments and cylindrical specimens in reverse Taylor impact experiments.

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