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Plasticity induced by pre-existing defects during high strain-rate loading[1]

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High strain-rate deformation of metals has been typically studied for perfect monocrystals. Computational advances now allow more realistic simulations of materials including defects, which lower the Hugoniot Elastic Limit, and lead to microstructures differing from the ones from perfect monocrystals. As pre-existing defects one can consider vacancy clusters, dislocation loops, grain boundaries, etc. New analysis tools allow analysis of dislocation densities and twin fractions, for both f.c.c. and b.c.c. metals. Recent results for defective single crystal Ta [Tramontina et al.., High Energy Den. Phys. 10, 9 (2014), and Ruestes et al., Scripta Mat. 68, 818 (2013)], and for polycrystalline b.c.c metals [Tang et al., Mat. Sci. Eng. A 580, 414 (2013), and Gunkelmann et al., Phys. Rev. B 86, 144111 (2012)] will be highlighted, alongside new results for nanocrystalline Cu, Ta, Fe, and Zr [Ruestes et al., Scripta Mat. 71, 9 (2014)]. This work has been carried out in collaboration with D. Tramontina, C. Ruestes, E. Millan, J. Rodriguez-Nieva, M.A. Meyers, Y. Tang, H. Urbassek, N. Gunkelmann, A. Stukowski, M. Ruda, G. Bertolino, D. Farkas, A. Caro, J. Hawreliak, B. Remington, R. Rudd, P. Erhart, R. Ravelo, T. Germann, N. Park, M. Suggit, S. Michalik, A. Higginbotham and J. Wark.

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