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**The origin of the Hugoniot Elastic Limit Spike and Precursor Decay and the interplay between dislocation nucleation and glide** ROMAN KOSITSKI, Technion - Faculty of Mechanical Eng. — A common feature in plate impact experiments in annealed body-centred cubic (BCC) metals at room temperature are the "spike and valley" shape of the elastic precursor wave, as well as the decay of the precursor wave called "elastic precursor decay". In this work, we propose a physically based, micromechanically-informed, multiscale continuum strength model that can capture these distinct features. We propose that the origin of these features is in the interplay between dislocation nucleation and dislocation motion. We use employ the overstress framework with dislocation glide rules, extracted from atomistic simulations, and we incorporated an Arrhenius-type homogenous dislocation nucleation term. Our simulations shed light on the origin of the elastic precursor decay and its fine details. We show that in the early stages of plastic deformation the spike and valley are controlled by dislocation nucleation rather than dislocation glide. As the shock propagates into the specimen, the strain rate decreases, and the relative contribution of dislocation glide to the stress relaxation increases while the dislocation nucleation rate decreases. As a result, the spike and valley vanish and the amplitude of the elastic precursor decays until reaching a steady-state value above a certain propagation distance. Using the proposed model we can show how initial material microstructure and temperature affect the elastic precursor similarly to what is seen in experiments.

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