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Investigation of laser shock induced ductile damage at ultra-high strain rate by using large scale MD simulations JEAN-PAUL CUQ-LELANDAIS, CEA-DAM Valduc, MICHEL BOUSTIE, Institut Pprime - UPR CNRS 3346, LAURENT SOULARD, CEA-DAM DIF, LAURENT BERTHE, PIMM - Arts et Metiers, JOËLLE BONTAZ-CARION, CEA-DAM DIF, THIBAUT DE RESSEGUIER, Institut Pprime - UPR CNRS 3346 — Laser driven shocks allow to investigate materials behavior at very high strain rate ($10^7 s^{-1}$) and presents a great interest for research applications. Microscopic simulations of ultra-short laser driven shock on micrometric Tantalum single-crystals have been performed by using the CEA-DAM Classical Molecular Dynamics code. This method, complementary to continuum models, provides an analysis the microscopic processes related to damage (ductile pore nucleation and growth) which occurs during spallation. This results are compared to spallation experiments data (VISAR signals, micro-tomography) obtained with the LULI100TW femtosecond laser in order to validate the MD behavior. Moreover, in the framework of a multi-scale approach, we show the possibility to use MD simulation to fit macroscopic damage models. This method is illustrated with an application to the parameters determination of the Kanel criterion. This also shows the high strain rates involved during damage process, around $10^9 s^{-1}$, allow to approach the inter-atomic theoretical cohesion stress threshold.

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