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Dynamic fragmentation as a possible diagnostic for high pressure melting in laser shock-loaded iron THIBAUT DE RESSEGUIER, LCD-CNRS, EMILIEN LESCOUTE, LCD-ENSMA, GUILLAUME MORARD, FRANCOIS GUYOT, IMPMC — High pressure melting of iron conditions the understanding of the Earth core constitution. For many years, shock compression has been used to complement the data obtained under quasi-static loading. However, shock-induced melting is uneasy to detect. Here, we investigate how dynamic fragmentation of laser shock- loaded iron is affected by melting. Thin iron samples are irradiated by a high power pulsed laser. The motion of the fragments ejected from the free surface is recorded using transverse shadowgraphy and soft recovery of the ejecta is performed in a low density gel. At low laser intensity, spalled layers can be seen in the shadowgraphs, and solid fragments of some tenths of mm are recovered. At higher intensity, a wide debris cloud is observed to expand from the free surface, and optical micrographs of the gel show some tiny spherical droplets of iron. This is consistent with the micro-spall process expected upon reflection of a triangular pressure pulse in a shock-melted metal. Hydrodynamic simulations accounting for laser-matter interaction, phase transformations and pulse decay during propagation are performed. The results are discussed to infer whether such experiments may provide data on melting of iron under high dynamic pressure loading.

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