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Contemporary Research of Dynamically Induced Phase Transitions[1]

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Dynamically induced phase transitions in metals, within the present discussion, are those that take place within a time scale characteristic of the shock waves and any reflections or rarefactions involved in the loading structure along with associated plastic flow. Contemporary topics of interest include the influence of loading wave shape, the effect of shear produced by directionality of the loading relative to the sample dimensions and initial velocity field, and the loading duration (kinetic effects, hysteresis) on the appearance and longevity of a transformed phase. These topics often arise while considering the loading of parts of various shapes with high explosives, are typically two or three-dimensional, and are often selected because of the potential of the transformed phase to significantly modify the motion. In this paper, we look at current work on phase transitions in metals influenced by shear reported in the literature, and relate recent work conducted at Los Alamos on iron's epsilon phase transition that indicates a significant response to shear produced by reflected elastic waves. A brief discussion of criteria for the occurrence of stress induced phase transitions is provided. Closing remarks regard certain physical processes, such as fragmentation and jet formation, which may be strongly influenced by phase transitions.

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