

SHOCK07-2007-020014

Abstract for an Invited Paper
for the SHOCK07 Meeting of
the American Physical Society

Shock compression properties of hard materials

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Through the measurement of Hugoniot parameters, we can get useful information about high-pressure phase transition, equations of state (EOS), etc. of solids, without pressure calibration. We have performed the Hugoniot-measurement experiments on various kinds of hard materials of calcogenides, oxides, nitrides, borides by using a high time-resolution streak camera system (inclined-mirror method) to investigate the yielding property, phase transition and EOS. It was found that almost all brittle materials behave as an elasto-isotropic solid unlike metals (elasto-plastic solid), except a very few materials such as TiB_2 . We observed the shock-induced phase transitions on ZnS , ZnSe , TiO_2 , ZrO_2 , $\text{Gd}_3\text{Ga}_5\text{O}_{12}$, AlN , B_4C , etc. Some oxide materials showed virtually incompressible EOS's in the high-pressure phase region. Here, the Hugoniot-compression data are reviewed, and the yielding property, phase transition and EOS of these hard materials are discussed. The applications for anvil materials, shock-resisted materials, etc. are also discussed.