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A new method to study he effective shear modulus of shocked material MA XIAOJUAN, LIU FUSHENG, College of Physical Science and Technology, Southwest Jiaotong University — Shear modulus is a crucial material parameter for description of mechanical behavior. However, at strong shock compression, it is generally deduced from the longitudinal and bulk sound velocity evaluated by unloading wave profile measurement. Here, a new method called the disturbed amplitude damping method of shock wave is presented, that can directly measure the shear modulus of material. This method relies on the correlation between the shear modulus of shock compressed state and amplitude damping and oscillation of an initial sinusoidal disturbance on shock front in concerned substance. Two important steps are required to determine the shear modulus of material. The first is to measure the damping and oscillation feature of disturbance by the flyer impacted method. The second is to find the quantitative relationship between the disturbed amplitude damping and shear modulus by the finite difference method which is applied to obtain the numerical solutions for disturbance amplitude damping behavior of sinusoidal shock front in flyer impacted flow field. When aluminum shocked to 80GPa is taken as an example, the shape of perturbed shock front and its disturbed amplitude development with propagation distance, are approximately mapped out. The figure shows an oscillatory damping characteristic. At the early stage the perturbation amplitude on the shock front experiences a decaying process until to zero point, then it rises to a maximum but in reverse phase, and then it decays again. Comparing these data with those simulated using the SCG constitutive model, the effective shear modulus for aluminum shocked to 80GPa is determined to be about 90GPa, which is higher than the result given by Yu.

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