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Shock-induced phase transitions and their effects on the dynamic strength in tin and tantalum JIANBO HU, CHENGDA DAI, HUA TAN, YUYING YU, XIANMING ZHOU, LINGCANG CAI, QIANG WU, LABORATORY FOR SHOCK WAVE AND DETONATION PHYSICS RESEARCH, INSTITUTE OF FLUID PHYSICS, CAEP, CHINA TEAM — We report our observations of shock-induced structural transformations in tin and tantalum based on precise sound velocity measurements. The measured sound velocity against shock pressure showed that there exist discontinuities in both tin and tantalum. Two observed discontinuities in the sound velocity of shocked tin are assigned to the bct-bcc transition and shock melting, respectively, which are confirmed by diamond anvil cell experiments after taking the temperature effect into account. The discontinuity of shocked tantalum, however, has no counterpart in diamond anvil cell experiments. We infer that tantalum under shock loading will undergo a shear stressinduced reversible Martensitic transition, according to the reported results of the shock recovery experiments. This inference may be helpful to explain the long-standing debate on the high-pressure melting curve of tantalum. For both metals, the deduced strength properties demonstrated significant changes around transition pressures, although the associated volume changes are slight, or even negligible. Therefore, it is easy to conclude that the strength of materials strongly depends on its high-pressure crystal structure.

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