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Structural phase transition in bismuth under shock compression measured via nanosecond time-resolved X-ray diffraction KAZUTAKA NAKAMURA, JIANBO HU, Tokyo Institute of Technology, KOUHEI ICHIYANAGI, The University of Tokyo, NOBUAKI KAWAI, Japan Aerospace Exploration Agency, KATSURA NORIMATSU, SHIN-ICHI HARADA, YUKI KABASAWA, DAI HORIUCHI, Tokyo Institute of Technology, SHUNSUKE NOZAWA, TOKUSHI SATO, SHIN-ICHI ADACHI, High Energy Accelerator Research Organization — Structural phase transition in bismuth under laser-shock compression up to 11 GPa has been studied via nanosecond time-resolved X-ray diffraction. The nanosecond time-resolved single-shot X-ray diffraction was performed using a laser-pump and X-ray probe technique with a 100-ps X-ray pulse from the synchrotron radiation facility (Photon Factory Advanced Ring, KEK). The sample was a polycrystalline bismuth foil with the thickness of 20 micrometers. The target assembly has a plasma-confined scheme and been irradiated by a 8-ns laser pulse. The results show that the shocked bismuth undergoes a series of structural transformations involving four solid structures: the Bi-I, Bi-II, Bi-III, and Bi-V phases. The transformation form the Bi-I phase to the Bi-V phase occurs within 4 ns under shock compression at maximum pressure of approximately 11 GPa, showing no transient phases with available experimental conditions. Successive phase transformations from the high-pressure Bi-V phase to the Bi-I phase via the Bi-III and the Bi-II phases during shock release within 30 ns have also been unambiguously resolved.

Kazutaka Nakamura
Tokyo Institute of Technology

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