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Morphology-Tuned Phase Transitions of Anatase TiO_2 Nanowires under High Pressure QUANJUN LI, BENYUAN CHENG, XUE YANG, RAN LIU, BO LIU, Jilin University, JING LIU, Institute of High Energy Physics, Chinese Academy of Sciences, ZHIQIANG CHEN, GeoScience Department, Stony Brook University, BO ZOU, TIAN CUI, BINGBING LIU, Jilin University — The phase transitions of one-dimensional (1D) anatase TiO_2 nanowires were studied by in situ high pressure synchrotron X-ray diffraction (XRD) and Raman scattering. A direct anatase-to-baddeleyite transformation was observed at $\sim$9 GPa, which is clearly different from the size-dependent phase transition behaviors for nanocrystalline TiO_2. We found the higher compressibility in the c-axis compared to the a-axis for anatase nanowires which may be attributed to both the crystal structural feature and the growth direction of the nanowires. This phase transition of the TiO_2 nanowires shows obvious morphology-tuned behaviors. Upon decompression, the baddeleyite phase transformed into α-PbO_2 phase. The morphology of the TiO_2 nanowires shows excellent stability and TiO_2 nanowires with α-PbO_2 phase were obtained at ambient conditions through a compression-decompression cycle. These results indicate that the nanoscale quasi-1D structure of TiO_2 nanowires may contribute to the high pressure phase transitions showing unique morphology-tuned behaviors.

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