The phase stability of Na-titanate nanotubes at high pressure was also investigated using HRTEM and diamond anvil cell technique and energy dispersive X-ray diffraction (EDXRD). The starting multi-wall (~4-6 layers) titanate nanotubes have an inner diameter of ~4-6 nm, outer diameter of ~9 nm and length of several microns. We used the bulk metallic glass as gasket to avoid the interference of gasket XRD peaks with samples’ pattern. XRD peaks of the nanotubes become broader and weaker as pressure increased, and finally transferred into an amorphous state at around 25 GPa. The multi-wall carbon nanotubes were also reported to be in amorphous at 10-20 GPa by in situ XRD observation. This might demonstrate that the titanate nanotubes are stronger than carbon nanotubes. Na cations bonding to the neighboring T-O octahedral layers result in the strength of the nanotubes under high pressure. Interestingly, the titanate nanotubes kept in an amorphous state with further compressed to 50 GPa according to the XRD observation. It was reported that the microparticle and nanocrystalline anatase (TiO₂) started to transfer to the baddeleyite structure at ~12-18 GPa. As it is known, the external pressure can depress the atomic diffusion, thus kinetically hinder the recrystallization of high-pressure TiO₂ phases after the nanotubes were crushed in our experiments.

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