Control of heat conduction through the manipulation of phonons as coherent waves have been attracted great interest for the advanced thermal management [1]. Although smooth interfaces were reported to be obtained in artificial superlattices, preparation of coherent interfaces for terahertz phonons having nanoscale periodicity with atomic-scale perfection are still challenging since metal organic chemical vapor deposition (MOCVD) and molecular beam epitaxy (MBE) were nonequilibrium growth process. Therefore, we focus on crystallographic shear (CS) structures, in which planar faults are periodically introduced to a mother structure with their spacing depending on their composition [2]. Homologous series of titanium-based oxides with CS structure have been long investigated by various researchers since Magneli and co-workers first reported in 1957 [3, 4]. Recently, we have revealed that the titanium oxides with CS structure possess nearly pristine interfaces and behave as coherent interface for thermal phonons [5-8]. In the present study, we have aimed to produce aperiodic arrangements of CS planes with nearly pristine interfaces toward experimental demonstration of phonon Anderson localization evoked by aperiodic arrangements of interfaces [9].

Figure 1 shows the transmission electron microscopy observation of titanium-chromium oxide crystals grown by floating-zone melting method before and after annealing at 1673 K for 24 h. Lines of satellite spots due to the arrangements of the CS planes are directed along the (121)$_{\text{rutil}}$ for both specimens. However, the interval of the satellite spots seems to be randomly arranged for the specimen before annealing while those for the specimens after annealing are homogeneous. HAADF-STEM observation (Fig. 1(c)) clearly show that the modulation of the interval of the CS planes for the specimen before annealing. Note that any anomaly in the atomic structure is noticed although the interval of CS planes are modulated. Current results implies that phonon Anderson localization, which was theoretically predicted in the materials having disordered interfaces, is expected to emerge in thermal conduction in titanium-chromium oxides with the modulated CS structures.

**Keywords:** Crystallographic shear structure, coherent phonon transport, titanium oxide

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