Successive Alternation of the Propagation Direction of the Inner Shell ordering by Pressure in a Cd-Yb 1/1 Approximant Crystal

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Cd_6Yb crystal, an approximant crystal of a binary quasicrystal of a Cd-Yb alloy, consists of a new type of atomic clusters that lack a partial icosahedral symmetry [1, 2]. The first inner shell of Cd_4, which has a tetrahedral shape instead of the typical icosahedral symmetry, is orientationally disordered at ambient pressure and temperature [2]. Single crystal synchrotron X-ray diffraction measurements revealed that the Cd tetrahedron exhibits various structural ordering sensitive to pressure and temperature. Four ordered phases appear in a *P*-*T* span up to 5.2 GPa and down to 10 K. The propagation direction of ordering alternates from [110] to [111] near 1.0 GPa and again to [110] at 3.5-4.0 GPa. The primarily ordered structures that appear between 210-250 K over a pressure span of 1-5.2 GPa further transform to finely ordered ones by cooling to 120-155 K. Super lattice reflection intensity measurements show that the structural transitions to primarily and finely ordered phases are driven by long and short-range interactions, respectively.

[1] Tsai A. P., Guo J. Q., Abe E., Takakura H., Sato T. J., *Nature*, 2000, **408**, 537. [2] Takakura H., Guo J. Q., Tsai A. P., *Philos. Mag. Lett*., 2001, **81**, 411.

Keywords: high-pressure phase transformations, quasicrystals, synchrotron x-ray diffraction