Phason Strain of quasicrystals and Staging of Layered Materials

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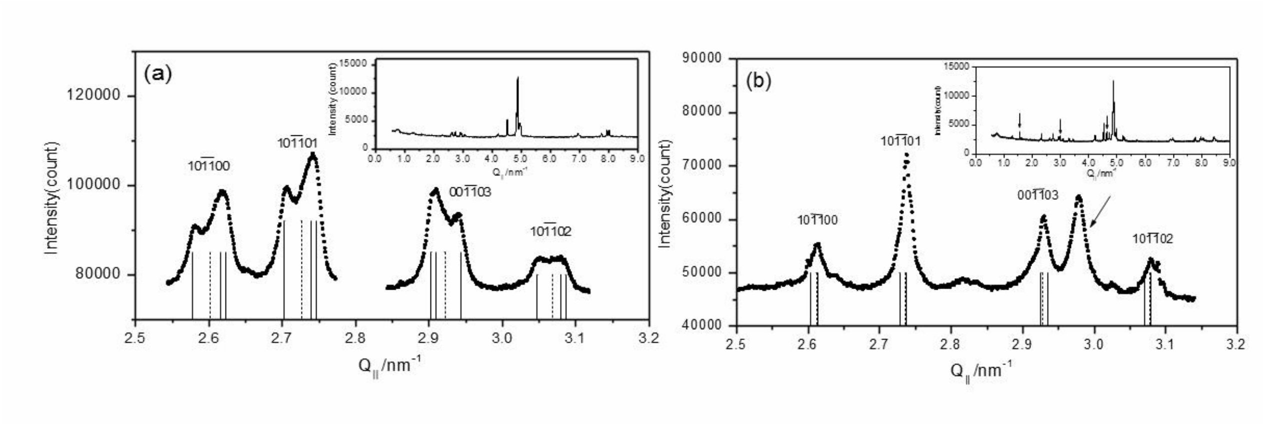

Peak profiles and simulated peak positions for $Al_{65}Cu_{18}Fe_9Mn_8$ (a) annealed at 800°C and (b) re-annealed at 880°C, respectively. The dotted lines represent identical decagonal peak positions and solid lines split-peak positions shifted relative to the identical positions as a result of the linear phason strains (a) $\theta_1 = \tau^{-6}$ and $\theta_2 = \tau^{-5}$, and (b) $\theta_1 = -\tau^{-8}$ and $\theta_2 = 0$.

Detection of phason strain in Al-based decagonal quasicrystals is performed by high precision X-ray diffraction measurement. The amount of linear phason strain is determined from the amount of shift of the X-ray peak from the ideal diffraction position with respect to the decagonal quasicrystalline phases such as Al-Ni-Co, Al-Mn-Pd and Al-Cu-Fe-Mn. As a result, τ-fold inflation of lattice constant from the crystalline phase to the quasicrystalline phase related to the Fibonacci sequence is observed, and the structural phase change from the crystal to the quasicrystalline phase can be understood.

Detection of staging in layered compounds such as Sn_xTaS_2 and (SnS) (TaS_2) n is carried out by X-ray diffraction. Sn atoms and SnS layers are inserted between TaS_2 layers. Although it is difficult to create a higher order stage, it was made possible by improving the iodine transport method.

Keywords : Quasicrystal, Phason Strain, Layered Material, Staging