Poster Presentation

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In-situ HRTEM observations of growth process of decagonal quasicrystals

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Quasicrystals possess quasiperiodicity, where the structure cannot be described simply by the repetition of unit cell like conventional crystals. This fact raises the question of how quasicrystals grow, i.e., what physical mechanism makes the growth of quasicrystals possible. While crystals can grow by copying a unit cell via local atomic interactions, nonlocal structural information seems to be required in the growth of quasicrystals. This problem has attracted much attention ever since the first discovery of a quasicrystal in 1984, and several theoretical growth models [1] have been proposed. However, no experimental studies have so far been reported, and it is still unclear whether these theoretical growth models apply to real quasicrystals. In the present study, we have conducted in-situ high-temperature electron microscopic (HRTEM: High-Resolution Transmission Electron Microscopy) observations of the growth process of decagonal quasicrystals to elucidate the growth mechanism. The growth processes of a decagonal quasicrystal of $Al_{70.8}Ni_{19.7}Co_{9.5}$ were observed by HRTEM in the temperature range 1073-1173K. Tiling patterns with edge length of about 2nm were constructed from a series of HRTEM images. They were analysed in the framework of the projection method. Here, we followed the procedures in our previous work [2]. We have already reported the results of some observations and analyses elsewhere [3]. However, the growth processes of them were on a small scale, and the results were indefinite. Recently, we have succeeded in observing a growth process on a massive scale. In this paper, we present the results of this observation and subsequent analyses, and discuss the growth mechanism of the quasicrystal.

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