Analysis of the structure of nanorods with pentagonal cross-sections by electron microscopy

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Abstract – A comprehensive electron microscopy analysis of the structure of silver multi-twinned decahedral-based nanorods (Dh-NWs) is carried out. Their high-resolution transmission electron microscope (HRTEM) images are interpreted as a Moirè pattern contrast based on a multi-twinned decahedron, and that their selected-area electron diffraction (SAED) patterns are completely generated through the same multi-twinned decahedron basis. Their structure can be interpreted as a chain of decahedra joined along the vertex in the five-fold symmetry axis.

In this work, we studied the experimental features of high-resolution transmission electron microscopy (HRTEM) images and the selected-area electron diffraction (SAED) patterns of silver nanorods with pentagonal cross-sections. In particular, we discovered that both HRTEM images and SAED patterns can be easily interpreted on the basis of a multi-twin decahedron. The observed contrast of HRTEM images can be explained in terms of Moirè fringes generated from the overlapping of the silver FCC unit cell planes of the five tetrahedra in the decahedron and we propose that the structure of these nanorods is better interpreted as a chain of decahedra joined along the vertex and parallel to the five-fold symmetry axis. This idea provides new insights about the remarkable structure of the nanorods [1].

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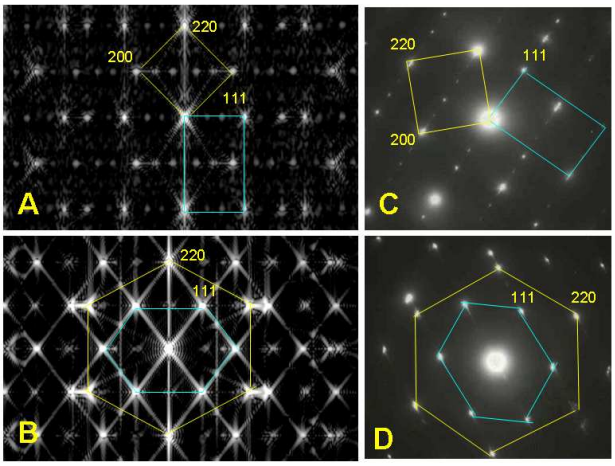

Figure 1 Comparison of the simulated SAED patterns (a, b) based on a decahedron model and the experimental SAED patterns (c. d) for the nanorods with pentagonal cross-sections s. Note the presence of the aperiodic sequence of diffracted spots in both cases.

References

[1] Further information in: J. Reyes-Gasga, J.L. Elechiguerra, C. Liu, A. Camacho-Bragado, J.M. Montejano-Carrizale and M. Jose Yacaman. J. Crystal Growth 286 (2006) 162–172