The thermodynamic studies show that the mesoscopic decahedron and icosahedron multi-twinned particles are not low-energy structures for clusters that have more than $10^5$ atoms. However, the decahedron and icosahedron lead particles grown with electrodeposition method consist of more than $10^{13}$ atoms. The growing mechanism of these pentagon-shaped particles is still unclear. For better understanding of the growing mechanism, the crystal structures of microns-sized lead mesoscopic decahedron and icosahedron particles were studied with x-ray microdiffraction at the Advance Photon Source. X-ray microdiffraction imaging with high spatial resolution (down to 200 nm) were performed to investigate the microstructure of the pentagon-shaped crystallites. The results show that the crystallographic structure of the decahedron and icosahedron particles is face-centered cubic and contains multi-twin structures. The tetrahedron unit blocks that compose a decahedron or an icosahedron particle are not necessarily perfect single crystals, exhibiting a mosaic structure whose orientation depends on the relative orientation to the crystal boundary.

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