Single crystalline tantalum oxychloride microcubes

Tantalum oxides usually refer to a class of substances deriving from Ta_2O_5, and have advantages of high dielectric constant, big refractive index, low internal stress, as well as large bandgap and resistivity. These advantages endow them with promising applications in electronics, photoelectrics and photocatalysis. However, it is still a great challenge to fabricate tantalum oxides with regular nano-/micro-morphologies, especially a single crystal structure due to the rapid hydrolysis rate of tantalum precursors. Recently, Prof. Guan's group from Wuhan University of Technology, China has for the first time reported a novel tantalum oxide - $TaO_{2.18}Cl_{0.64}$ single crystalline microcubes (MCs) in *Chem Commun* published by RSC. They have elaborately kept an almost constant strong acidic environment in the whole hydrolysis reaction process of Ta^{5+} ions by using a mixed hydrochloric acid-acetic acid solution, leading to the anisotropic growth of the $TaO_{2.18}Cl_{0.64}$ product with selective crystallographic facets. This is an advanced approach to obtain well crystalline Ta based oxides with a unique morphology, and provides a possibility for the decipherment of the relationship between the chemophysical properties and the exposed facets of tantalum oxides. This method also paves a way for the preparation of metal oxide single crystalline micro/nano- materials out of the corresponding precursors with extremely rapid hydrolysis rates.

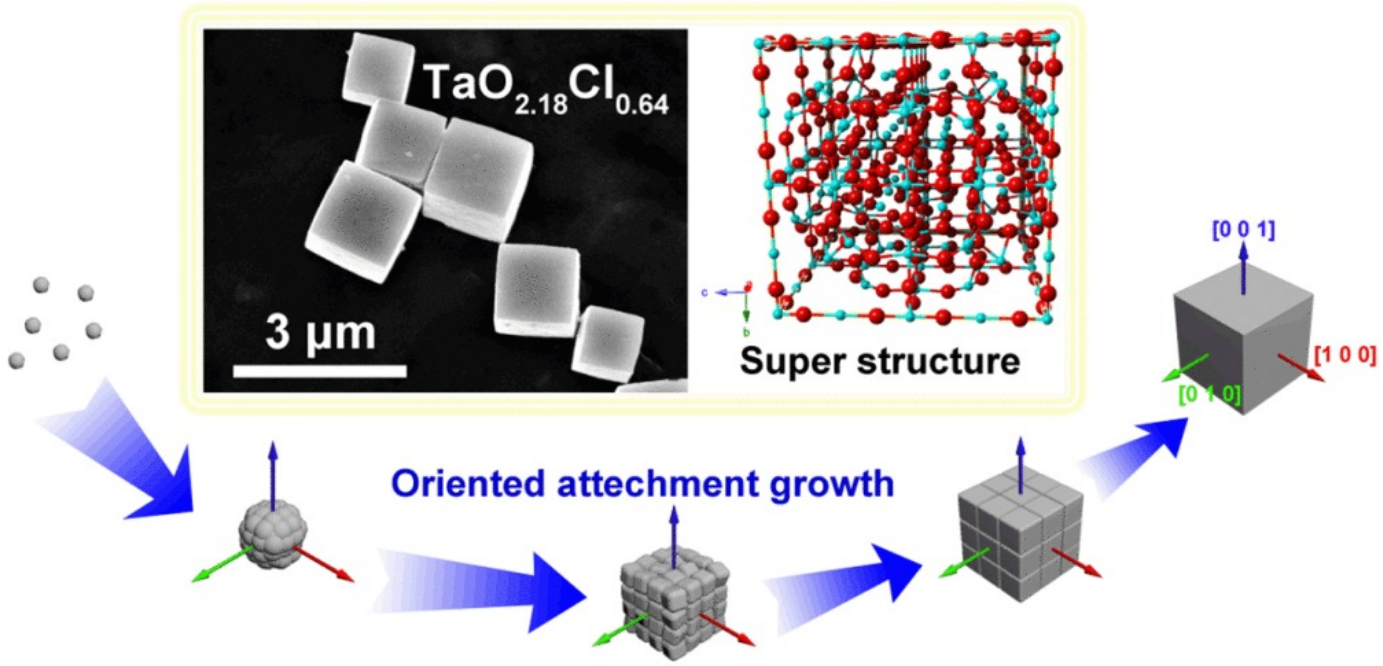

Fig. 1. The SEM image, as well as the illustrations of the superstructure and the growth kinetics of the as-prepared TaO2.18Cl0.64 single crystalline microcubes

The as-obtained single crystalline $TaO_{2.18}Cl_{0.64}$ MCs are a new substance with superstructures containing disorders in the lattices. They exhibit an attractively enhanced photocatalytic activity for hydrogen production due to the accelerated charge transfer and improved light harvest, steming from the unique monocrystalline structure, as well as the incorporation of halide ions into the crystal lattice.

Publication

Single crystalline tantalum oxychloride microcubes: controllable synthesis, formation mechanism and enhanced photocatalytic hydrogen production activity.
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