● FY2012 Jun Takada （Professor, Okayama University）

Toward Creating Innovative Applications to Harness the Novel Functions of Nano-scaled Iron Oxides of Microbial Origin

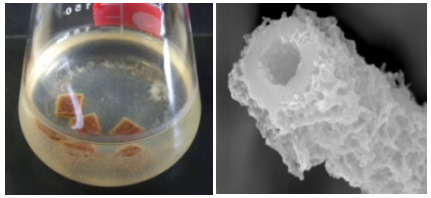
Research Project Outline (From Oct. 2012 to Mar. 2017)

Structural and functional analyses of unique iron oxides of bacterial origin , BIOX, and their mimic iron oxides artificially synthesized

◎ Iron oxides produced by bacterial culture: Creation of novel nano-scaled iron oxides by artificial culture of isolated Fe-oxidizing bacterium (strain OUMS1) under altered culture conditions

◎ Synthetic iron oxides: Creation of novel nano-scaled low-cyrstalline iron oxides by adjusted preparation of chemicals in reference to chemical characters of the bacterial product

→Toward creation of novel eco-friendly innovative functional materials [e.g., great potential as electrode of Li ion rechargeable battery, high affinity to human cells, efficient catalytic potential, high grade pigment etc.]



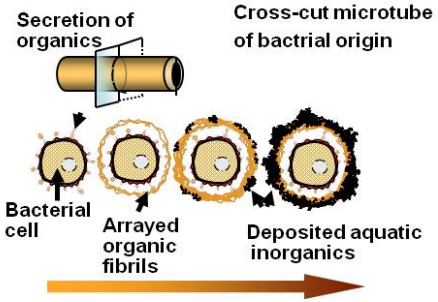
Iron oxides produced by bacterial culture

Research Results (FY2012)

◆ Elucidation of formation process of microtubular iron oxides of bacterial origin

- ✓ Elucidation of the initial formation process revealed by 1-3 day culture of an isolated bacterium strain (OUMS1), followed by transmission electron microscopy
- ✓ Microtubular iron oxides (ca. 1μm diameter) of inorganic/organic hybrid structure
- ✓ Two step formation process: i) initial assemblage of organic fibrils secreted from bacterial surface to form tubular frame, ii) subsequent deposition of aqueous-phase inorganics to form the immature tube skeleton, resulting in bondage of iron oxides

***Minerals*, 3, 73-81 (2013)**

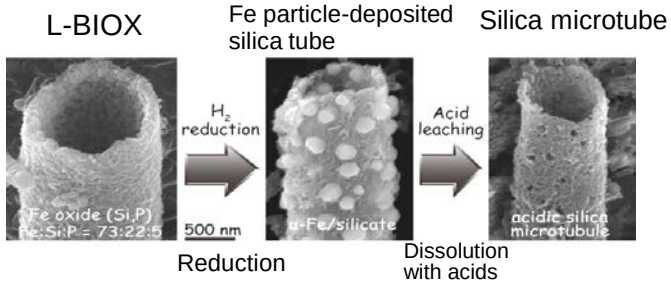


Formation process of L-BIOX

◆ Creation of amorphous silica microtube

- ✓ Two-step removal of Fe from microtubular iron oxides of bacterial origin (major element composition Fe:S:P=0.75:0.20:0.05): i) Creation of silica microtube by deposition reduction of Fe, ii) Dissolution and removal of Fe from the tube with acids
- ✓ Characters of tube: high specific surface, strong acidic center, efficient catalytic potential etc.

***Applied Materials & Interfaces*, 5, 5194-5200, (2013)**



Fabrication process of amorphous silica microtube