

# Functionalized Nano-porous Silicates Produced from Natural Sediments by Iron Oxidized Bacteria

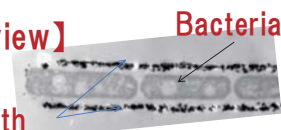
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## 【Brown Sediments by Iron Bacteria】



【Cross-section view】



【Features】 **BIOX**

Sheath

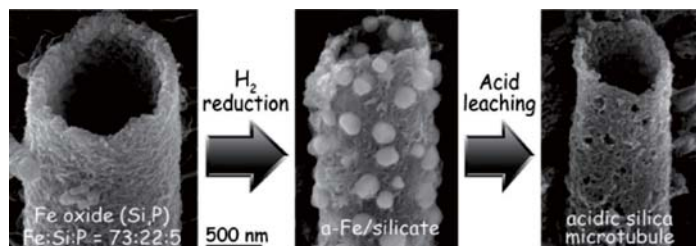
- Abundant in iron-containing water
- Tubular shape: diameter 1.3 μm
- Aggregated primary particles (3nm)
- Si concentration **Fe: Si: P = 75: 20: 5**  
(Ubiquitous atomic concentrations)

## Heat & Acid Leach

## 【Nano-Porous Silicate Tubes】

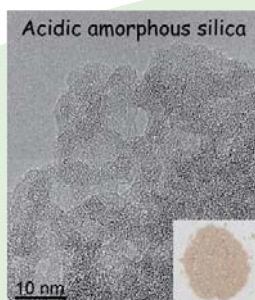
【Features】 **BSL**

- Amorphous micro-tubes (0.7 μm dia.)
- Porous & high surface area (**540 m<sup>2</sup>/g**)
- Aggregated primary particles (6nm)
- Strong solid acid properties
  - ◆ Tubular silica derived from microorganisms
  - ◆ Reuse and recycling of worthless wastes



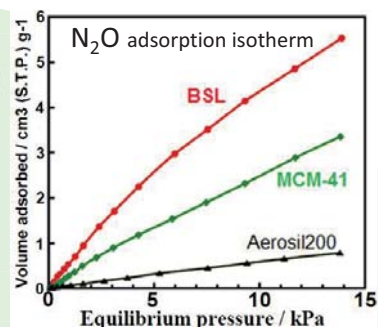
**Unique Eco functional Materials  
Invented by Okayama University**

**Nano-structure**

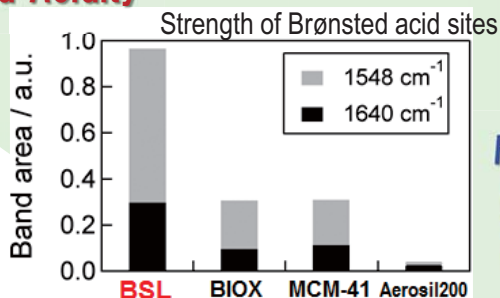


**Gas-adsorption**

**Biogenous Silicates (BSL)**

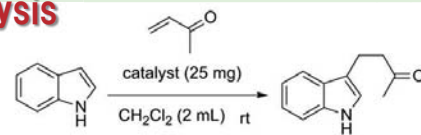


**Solid Acidity**



**Functionalities beyond the synthetic silicates (MCM-41, Aerosil200)**

**Catalysis**



catalyst	yield / %	time
BSL	84	5 days
BIOX	46	7 days
Aerosil200	5	5 days
MCM-41	74	3 days

【Article】 H. Hashimoto, *et al.*, Nano-Micrometer-Architectural Acidic Silica Prepared from Iron Oxide of *Leptothrix ochracea* Origin, *ACS Appl. Mater. Inter.*, 5 (2013) 5194-5200.

【Patent】 PCT/JP2012/056452 (特願2011-056876), Inventors: Jun TAKADA, et al., 「Novel porous amorphous silica and production method therefor」, Filing Date: 2011.3.15