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*A keynote talk*

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## BIOLOGICAL FORMATION OF MESOPOROUS AMORPHOUS AND CRYSTALLINE MATERIALS

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### Abstract

Mesoporous materials can be synthesized through different approaches. In this paper, we report a biological approach, by which high purity mesoporous amorphous silica is synthesized. This approach is discovered by studying the macro- and microstructures and the formation mechanism of the freshwater sponge *Cauxi* that were collected at the river bank of the Rio Negro in the Amazon basin. The study revealed that the skeleton of sponges is constructed by amorphous silica spicules (average diameter: 15.6  $\mu\text{m}$ ) that are cemented by proteins at the junctions. Such amorphous spicules contain randomly oriented mesopores. The characterization of the freshwater sponge *Cauxi* shows that the mesoporous amorphous silica can be synthesized in aqueous solution under ambient conditions via biological catalysis. Here we describe the macro- and microstructural features, the mechanism of biological precipitation, and the glass transition of the *Cauxi* skeleton.

In addition, we established a bio-mimetic approach for synthesizing high-performance mesoporous crystalline  $\text{TiO}_2$ . The key step of this approach is to apply Baker's yeast cells as biotemplates for deriving the hierarchically ordered mesoporous anatase structure. The yeast- $\text{TiO}_2$  exhibits remarkable electrocatalytic activities and outstanding photocatalytic performances. The approach may open new vistas for fabricating advanced mesoporous crystalline materials under ambient conditions.

### References:

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