# ORIGINAL SOL-GEL SYNTHETIC APPROACHES TO HIGH-PERFORMANCE TI-$SIO_2$ CATALYSTS

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**ABSTRACT:**

The simultaneous control over active site speciation and texture is a key for materials used as heterogeneous catalysts. Those features are known to rule respectively the intrinsic activity and the accessibility of the active sites, thus triggering intensive research on the design of efficient catalysts combining large pores, high specific surface area, and proper dispersion of the active species. Additional challenges include the resistance to water, the shaping of the materials for industrial flow processes, and the coupling of several functionalities (e.g. an inorganic species and an enzyme) in a single solid in order to envisage sustainable one-pot cascade reactions.

Herein, we present an overview of innovative sol-gel strategies – including aerosol-assisted methods and soft-templating routes – which successfully address those challenges for the bottom-up preparation of efficient Ti–$SiO_2$ catalysts with tunable texture, pore architecture, Ti loading, surface composition, and also with possible scale-up and use in flow processes (Figure 1a–b).[1] We also cover an original strategy we recently developed to prepare hybrid chemoenzymatic heterogeneous catalysts (Figure 1c)[2] and we illustrate the approach for the epoxidation of olefins with *in situ* production of the oxidant.[3]

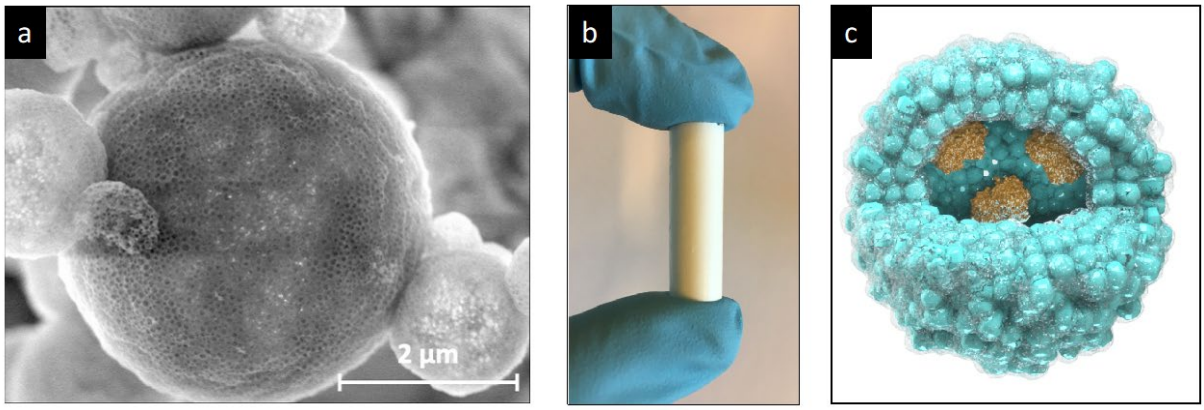


**Figure 1 : Various types of Ti-$SiO_2$ obtained by bottom-up sol-gel strategies. a) hierarchically porous Ti-$SiO_2$ spheres *via* aerosol-assisted sol-gel, b) self-standing macrocellular Ti–$SiO_2$ monoliths *via* emulsion-templated sol-gel, c) bio-inorganic hybrid microstructures *via* sol-gel-assisted assembly of zeolites.**

**References**

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2- Debecker D. P, Smeets V, Van der Verren M, Meersseman Arango H, Kinnaer M, Devred F (2021) Curr. Opin. Green Sustain. Chem. 28, 100437.
3- Smeets V, Baaziz W, Ersen O, Gaigneaux E. M, Boissière C, Sanchez C, Debecker D. P (2020) Chem. Sci. 11, 954–961.