**Nanoengineered materials for catalytic cascades**

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Heterogeneous catalysis a key enabling technology, contributing ~US$15 trillion to global GDP, and underpinning socioeconomic advancement through the production of fuels, chemicals, pharmaceuticals, and environmental remediation of anthropogenic waste. However, current global challenges at the water-energy-food (and materials) nexus require a new generation of ultraselective and atom/energy efficient catalysts and associated processes;1 one-pot catalytic cascades are especially desirable.2

Here we describe a general route to a novel class of spatially orthogonal (i.e. mutually exclusive) bifunctional porous materials, which permits the chemical environment of macropores and mesopores to be independently tuned.3 The hierarchical nature of the parent pore networks regulates active site accessibility4 and communication between different spatially localised catalytic functions (Figure 1), offering unprecedented control over multi-step cascade transformations for the biofuels production and chemical synthesis. This design strategy is illustrated for acid-base and bimetallic Pd-Pt spatially orthogonal catalysts for biodiesel production from low-grade oils5 and the synthesis of value-added chemicals.3



Figure 1. *(left) Spatially orthogonal chemically functionalised Pd macroporous-Pd mesoporous SBA-15, and (right) catalytic advantage for the aerobic selective oxidation of cinnamyl alcohol.*

**References**

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