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Design of nanocatalysts for improved selectivity and stability

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Several examples from ongoing work in our laboratory on the use of self-assembly to prepare heterogeneous catalysts with novel architectures will be discussed in this presentation. In one case, catalysts consisting of dispersed platinum metal nanoparticles with narrow size distributions and well-defined shapes were prepared and tested for the selective promotion of carbon-carbon double-bond cis-trans isomerization reactions in olefins. It was shown that the selective formation of the cis isomer could be controlled by using tetrahedral particles with exposed (111) facets. In a second example, catalysts based on small platinum nanoparticles of well-defined sizes were made by using dendrimers as scaffolding structures. The organic framework in that case can provide new fuctionality, including chirality as a way to introduce enantioselectivity. The third example involves the control of metal nanoparticle sintering by covering those with a layer of mesoporous silica grown on top. The final case to be discussed is one where yolk@shell metal-semiconductor constructs are being developed for increase stability in oxidation and photocatalytic applications.