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Enhancement of the Performance of a Platinum Nanocatalyst Confined within Carbon Nanotubes for Asymmetric Hydrogenation

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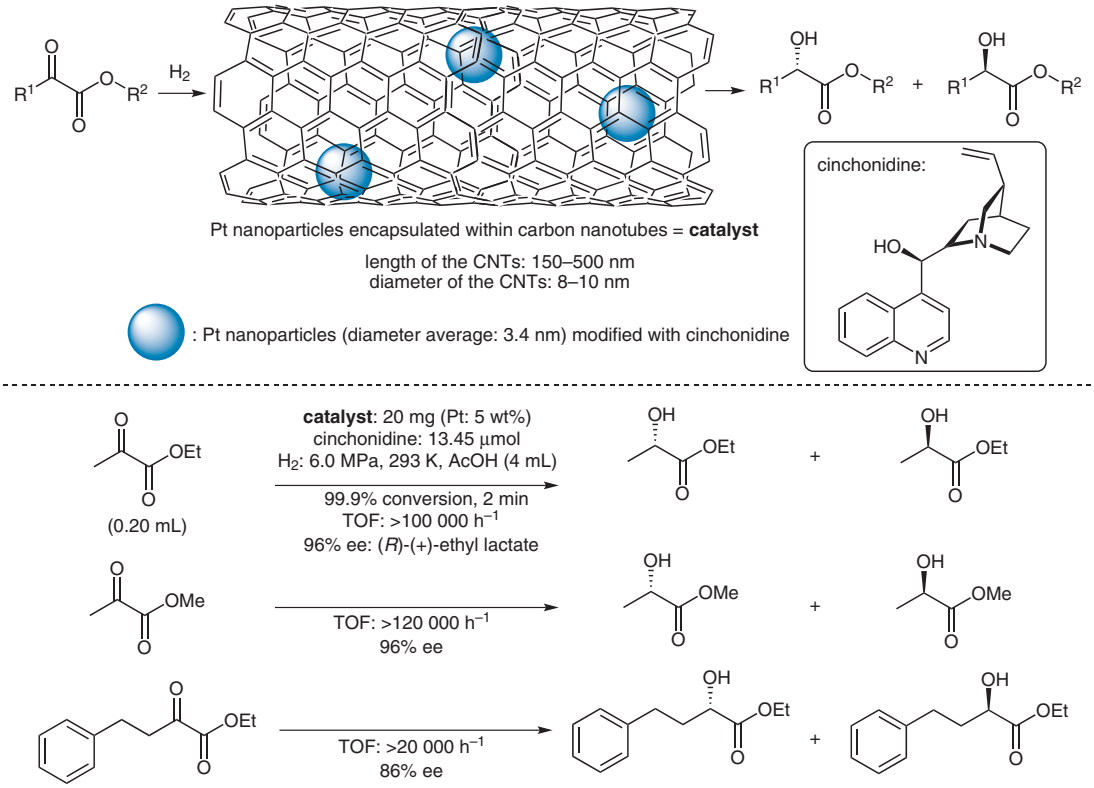
A Platinum Nanocatalyst Confined within Carbon Nanotubes



Significance: A Pt nanocatalyst confined within nanochannels of carbon nanotubes (CNTs) was described. Treatment of multi-wall CNTs with 68 wt% HNO_3 (140 °C, 14 h) gave the CNTs with open ends. After ultrasonication of the CNTs and H_2PtCl_6 in H_2O for 3 h, the mixture was stirred at r.t. for 48 h, and then heated to 110 °C with a heat range of 1 °C/min and held at 110 °C for 24 h. Reduction of the catalyst precursor with sodium formate led to Pt nanoparticles within the channel of CNTs, which were modified with cinchonidine in AcOH. Asymmetric hydrogenation of α-keto esters was performed under H_2 using the chirally modified catalyst affording the corresponding α-hydroxy esters with 86–96% ee.

Comment: Pt nanoparticles encapsulated within the nanochannel of CNTs [Pt/CNTs(in)] were characterized by TEM, HRTEM (high-resolution transmission electron microscopy), N_2 chemisorption, and CO chemisorption. Pt nanoparticles located on the outer surface of CNTs [Pt/CNTs(out)], Pt/AC (active carbon), and Pt/Al_2O_3 showed lower catalytic activity under similar conditions. Pt/CNTs(in) were recovered by centrifugation (or filtration), and re-modified by cinchonidine in AcOH. The Pt/CNTs(in) catalyst was reused nine times without significant loss of catalytic activity (1^{st}: 99.9% conversion, 96.4% ee; 10^{th}: 99.9% conversion, 95.7% ee).

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Category

Polymer-Supported Synthesis

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