Mesoporous structure enhances catalytic performance of single-atom catalysts

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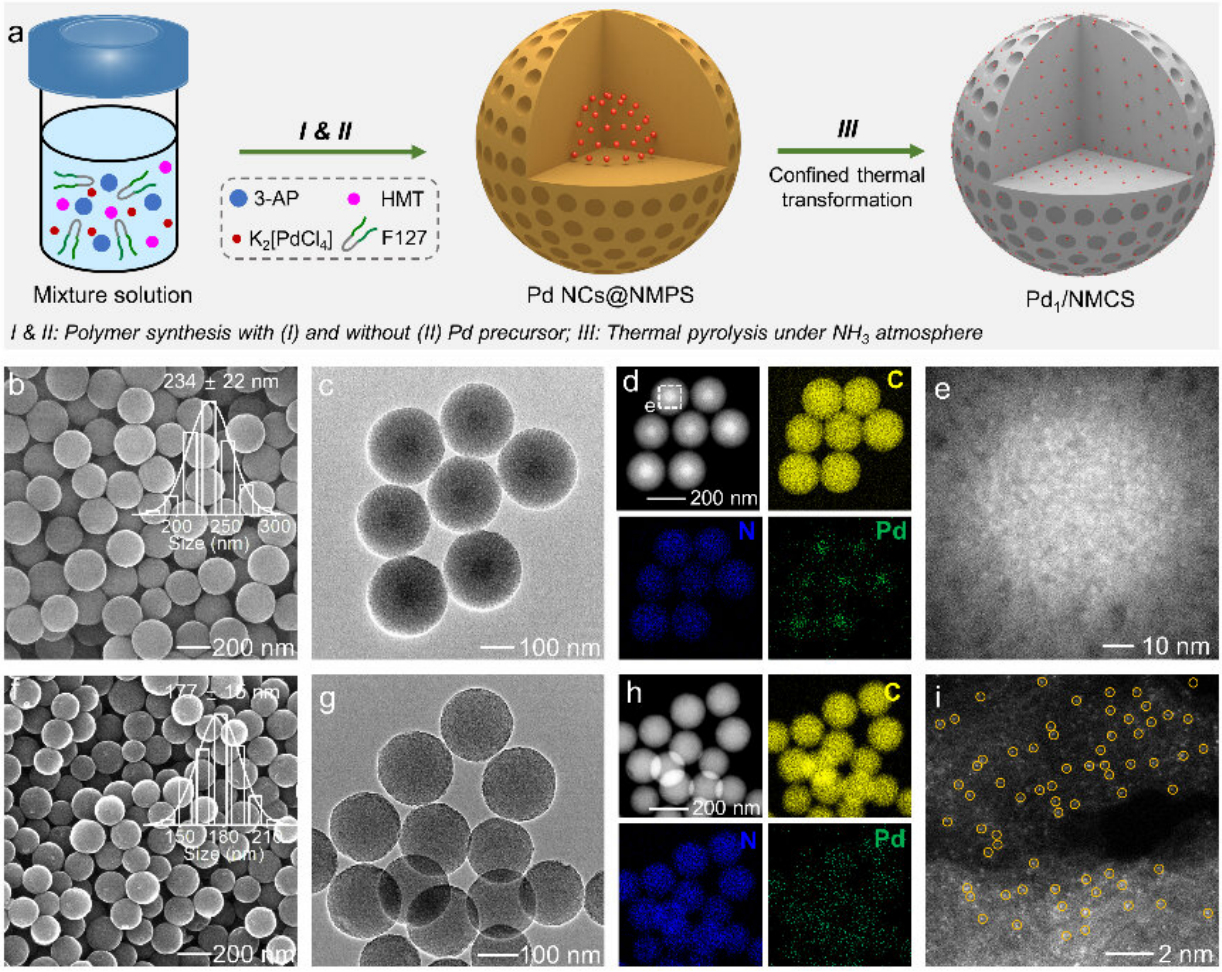

Synthesis and characterization of Pd1/NMCS using thermal transformation strategy. Credit: TIAN Zhengbin

Carbon-supported single-atom catalysts (SACs) are promising in heterogeneous catalysis due to their high atomic utilization efficiency and unique catalytic performances.

However, maximum utilization of the carbon-supported single atoms is very challenging, since many single atoms are probably embedded in the carbon matrix and thus not available during catalysis due to the mass transfer limitation.

Recently, researchers from the Qingdao Institute of Bioenergy and Bioprocess Technology (QIBEBT) of the Chinese Academy of Sciences (CAS) have developed a confined thermal transformation strategy to synthesize nitrogen-doped mesoporous carbon nanospheres (NMCS)-supported SACs.

The study was published in *Journal of Materials Chemistry A* on Oct. 22.

In this study, the researchers reported a soft-templating method to synthesize the core-shell mesostructured polymer nanospheres with metal nanoclusters (M-NCs, M=Pd, Pt) as the core, which can be easily converted into the NMCS-supported SACs (M_1/NMCS) after a confined thermal transformation process.

"The thermal transformation process happens in the NMCS, and the loss of metal is avoided to a great extent," said Prof. Wang Guanghui, the senior author of the study.

By this strategy, Pd_1/NMCS and Pt_1/NMCS were prepared with rich porosity and high N content. The synthesized Pd_1/NMCS sample showed enhanced catalytic performance in the selective hydrogenation of quinoline compared with Pd1/NCS without mesopores.

"The enhanced activity indicates to some extent that the mesoporous

structure of Pd_1/NMCS is indeed beneficial for the exposure of active cites and the mass transfer," said Prof. Wang.

More information: Zhengbin Tian et al, Confined thermal transformation strategy to synthesize single atom catalysts supported on nitrogen-doped mesoporous carbon nanospheres for selective hydrogenation, *Journal of Materials Chemistry A* (2021). DOI: 10.1039/D1TA08365A

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