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Enhancing catalytic properties of ligand-protected gold-based 25-metal atom nanoclusters by silver doping
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Abstract
Herein, engineering metal composition of metal nanoclusters (NCs) by foreign metal doping was used as an approach to synthesize gold (Au)-based 25-metal NC catalysts, without compromising the presence of their ligands and unique structure of 25 metal atoms. The Au-based 25-metal atom NCs with silver doping which can also be called as bimetallic AuAg NCs (i.e., Au25-xAgx(SR)18 NCs with x = 4–12) were successfully synthesized by co-reduction method with various feeding ratios (RAu/Ag = 24/1, 22/3 and 18/7). The Ag dopants favorably replaced Au(0) atom on the vertex of the icosahedral core and enhanced the catalytic activity of bimetallic Au25-xAgx(SR)18 NCs due to combination of several factors. As compared to monometallic Au25(SR)18 NCs, Au25-xAgx(SR)18 NCs have (1) synergistic effects of Au and Ag atoms; (2) better ligands removal's and active sites exposure due to weaker Ag-SR bond than Au-SR bond based on DFT analysis; (3) weaker Ag-H than Au-H bond based on DFT analysis; and (4) better stability as smaller metal NCs during the catalytic reaction. The study reveals a wider opportunity to tailor the catalytic properties of atomically precise Au-based 25-metal atom NC by engineering its metal composition. © 2021 Elsevier B.V.

Author Keywords
4-nitrophenol hydrogenation; Bimetallic nanoclusters; Gold nanoclusters; Gold-silver nanoclusters

Index Keywords
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