

Selective Hydrogenation of Syngas- and Biomass-Derived Carboxylic Acids and Esters over Supported Bimetallic Nanoparticles with Coinage Metals

(担持貴金属2元系ナノ微粒子を使った合成ガス由来, バイオマス由来カルボン酸およびエステルの選択水素化)

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Bimetallic nanocrystals containing coinage metals like Au, Ag and Cu have generated immense interests in catalysis because they offer a way to fine-tune the catalytic properties by controlling the composition and active species. For instance, it has been reported that a number of Au-containing bimetallic catalysts like Au–Cu, Au–Ag, Au–Pt and Au–Pd can exhibit improved catalytic performances in a variety of reactions. For instance, the synergistic effect and improved activity via Au–Ag alloying have been obtained in particularly for low-temperature CO oxidation. However, to the best of our knowledge, the catalytic properties of supported bimetallic catalysts with coinage metals for the gas-phase selective hydrogenation of carboxylic acids and esters have not yet been fully studied.

Herein, we report that several bimetallic catalysts with coinage metals, namely Cu–Au, Cu–Ag and Au–Ag, exhibit remarkable activity and thermal stability for the selective hydrogenation of carboxylic acid and its derivatives like syngas-derived dimethyl oxalate to ethylene glycol or methyl glycolate and biomass-derived levulinic acid to γ -valerolactone. We found a combined tuning of particle dispersion and its surface electronic structure is shown as a consequence of the changes in the size and valence band structure of coinage metals, which leads to significantly enhanced synergy.

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EDUCATION AND RESEARCH EXPERIENCE

Dr in Eng., Nanjing Forestry Univ. (1990)•Dr. in Sci., The Univ. of Tokyo (2000)•Professor, Xiamen Univ. (1997–)

RESEARCH INTERESTS

Catalysis in connection to energy recovery and chemical synthesis. The target reactions are including: transformations of syngas- and biomass-based ethers and esters, in particular, focusing on selective hydrogenation, Oxo synthesis, selective oxidation, etc.

HONORS AND AWARDS

The second prize, award of natural sciences of Chinese Universities (MOE of China, 2000)•the excellent and key teacher (MOE of China, 2002)• the first prize, award of teaching achievements (Fujian Province, 2004)•the second prize, the award of teaching achievements (MOE of China, 2005)

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