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ABSTRACT:

The Role of the Size and Shape of Sub-Nanometric Pt Clusters and Nanoparticles on their Efficiency for the Catalytic Conversion of Ethylene Glycol and Glycerol to High Value Products and Molecular Hydrogen

C. Evangelisti

Istituto di Chimica dei Composti Organometallici (CNR-ICCOM), Via G. Moruzzi 1, 56124 Pisa, Italy; E-mail: claudio.evangelisti@cnr.it

Sub-nanometric clusters (SNCs), with sizes between single atoms and nanoparticles, have become a hot topic of research in the field of catalysis [1]. SNCs exhibit unconventional physical and chemical properties, mainly including unique electronic structures, higher metal utilization efficiency, and unsaturated coordination environment. Recently, these peculiar features displayed considerable promise in conventional thermocatalytic reactions, as well as in electrocatalytic and photocatalytic processes.
We report herein the synthesis of both sub-nanometric Pt clusters (dm = 0.35 nm) and ultrasmall nanoparticles with different sizes (dm = 1.5 nm and 2.5 nm, respectively) by metal vapor synthesis (MVS) approach [2] and then deposited onto high surface area carbon supports. The final size of the Pt species was strictly controlled upon the metal atoms growth in different solvents (i.e. mesitylene, acetone, n-pentane). The catalytic performances of these materials for the conversion of biomass-derived glycerol and ethylene glycol to high added value products (i.e. 1,2-propandiol, lactic acid and glycolic acid molecular hydrogen, respectively) will be presented and discussed. Particular attention will be devoted to the correlation between the morphological and structural features of the supported Pt species and their catalytic properties in terms of activity, selectivity and stability/durability.

[1] C. Dong, Y. Li, D. Cheng, M. Zhang, J. Liu, Y.-G. Wang, D. Xiao, D. Ma, ACS Catal., 10(19), 11011, (2020).
[2] E Pitzalis, R Psaro, C Evangelisti, Inorg. Chim. Acta 533, 120782, (2022).