Glycerol-Silver Catalysts: Effect Of Catalyst Structure

On The Selectivity Of Glycerol Oxidation.

A. Jouve¹, M. Stucchi¹, S. Cattaneo¹, A.Villa¹, C. Evangelisti², A. Beck³, R. Zanella⁴, L. Prati¹

(1) Dipartimento di Chimica, Università degli Studi di Milano, via C.Golgi 19, 20133 Milano, Italy
(2) Istituto di Scienze e Tecnologie Molecolari (ISTM-CNR), Via G. Fantoli 16/15, 20133 Milano, Italy
(3) Centre for Energy Research, MTA, Konkoly Thege Miklós út 29-33, 1121 Budapest, Hungary
(4) UNAM Centro de Ciencias Aplicadas y Desarrollo Tecnologico, UNAM, Circuito Exterior S/N, Ciudad Universitaria, Apartado Postal 70-186, Delegación Coyoacán, C.P. 04510 Cd. de México, Mexico

Glycerol constitutes a very useful, renewable platform molecule which can be transformed in a huge amount of chemicals of industrial interest. Particularly under oxidative conditions in a basic medium it has been shown that the main product is glyceric acid. Its subsequent oxidation to tartronic acid has been shown to be promoted by Bi-modified systems (1,2) which however normally present low stability undergoing easy leaching of the promoter. Therefore, the development of long-life catalysts allowing a sustainable production of tartronic acid could be not only of scientific but also of industrial interest. Tartronic acid is indeed used as an oxygen scavenger in food industries.

This contribution deals with the modification of gold catalyst, a well-recognized catalyst for glycerol oxidation, with silver investigating the impact of the bimetallic structure on the selectivity (and activity) of the reaction in order to develop a stable, highly selective catalyst.

Three different synthetic methods (namely sol immobilization (3), solvated metal atom deposition (4), deposition-precipitation (5) have been used to prepared AuAg bimetallic catalysts. Despite a very similar particle size distribution and composition a strongly different selectivity in glycerol oxidation (0.3M solution, 50°C, 3atm O2, glycerol/metal 2000 mol/mol, glycerol/NaOH 4 mol/mol) has been revealed. In particular, we revealed by XPS, Auger and XANES analyses different bimetallic structures which are promoting different reaction pathway.

References

Corresponding author email: laura.prati@unimi.it