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Synthesis of Ag/YSZ nanocomposites thin films by reactive magnetron co-sputtering at high pressure for the electrochemical promotion of catalysis of ethylene into ethylene oxide

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The electrochemical promotion of catalysis is a well-known process [1] which enables to modify in operando performances of catalytic layer deposited onto electrolytic thick membrane. Indeed, by applying an electrical potential between a reference and a working electrode the migration of electronic membrane ions via Schottky defects is promoted what is modifies the oxygen reactivity at the catalyst surface. Institut Jean Lamour (IJL) has recently developed nanostructured electrochemical catalysts by magnetron sputtering in a multisource approach in which the catalytic film is a composite consisting of metal nanoparticles highly dispersed in an electrolyte matrix [2]. Au/YSZ nano-composite thin films deposited on β"-Al_2O_3 were found to be active in the partial oxidation of methanol with a high selectivity towards methyl formate. From this perspective, the first line of the EPOX project is the synthesis of dense working thin film electrodes made of Ag/YSZ using reactive co-sputtering for the electrochemical promotion of catalysis of ethylene into ethylene oxide. In order to obtain nano-dispersed silver within a ion conductive matrix, the elaboration conditions such as reactive partial pressure, working distance pressure product, pumping speed and electrical parameters have been tuned. The silver concentration within thin films was assessed by EDX in SEM. The fluorite type structure of YSZ and the cubic structure of Ag was determined by XRD. Thanks to HRTEM the presence of silver clusters has been highlighted as well. Last but not least, a botryoidal-like structure and the roughness of the films were respectively revealed and evaluated by SEM in high resolution top view and by AFM.
[1] P. Vernoux et al., Chem. Rev. 113 (2013) 8192.
[2] J.Gonzalez-Cobos et al., J.Catal. 317 (2014) 293.

Keywords
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