Ruthenium nanostructured catalysts on porous support for Hydrogen Evolution Reaction

Rachela G. Milazzo [a], Giuseppe Tranchida [a,b], Corrado Bongiorno [a], Guglielmo G. Condorelli [b], Salvatore A. Lombardo [a] and Stefania M. S. Privitera [a]

[a] *CNR-IMM VIII Strada 5, 95121 Catania, Italy.*

[b] *Department of Chemical Sciences, University of Catania, Viale Andrea Doria, 6, 95125 Catania, Italy.*

Corresponding author email: gabriella.milazzo@imm.cnr.it

The production of hydrogen by water electrolysis seems to be a very promising approach and can help to achieve a clean, secure, and affordable energy future (1). However, the development of affordable technologies for green hydrogen production relies directly on the development of efficient electrocatalysts for the hydrogen evolution reaction (HER). Platinum is the most efficient catalyst, but its widespread application is limited by high cost and scarcity. Ruthenium represents an interesting candidate among Pt group metals since it has proper bond strength with hydrogen, good stability, and a cost less than half of that of Pt (2).

In this work we have electro-deposited Ru catalysts nanostructures on porous supports and tested their activities in both alkaline and acidic electrolytes. The XPS measurements have confirmed the presence of both metallic and oxidized Ruthenium, while morphological analyses have pointed out that by properly choosing the experimental parameters, it is possible to entirely cover the porous supports. Electrochemical characterizations have shown a catalytic activity comparable with that of Platinum with a Tafel slope of 34mV dec^{-1} and 90 mV dec^{-1} in alkaline and acidic electrolytes respectively, quite similar to those found for Pt electrodes tested under similar conditions. The Ru loading in both cases is below 0.1mg cm^{-2} in very good agreement with the recommendation of DOE (3).

References:

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