ParisTech

Chimie Paris ParisTech | PSL

RESEARCH TOPIC FOR THE PARISTECH/CSC PHD PROGRAM

Field: Chemistry, Physical Chemistry and Chemical Engineering

Subfield: (Applied Physics, Chemistry, Mathematics, Mech. Eng.…)

Title: Synthesis of innovative nanomaterials for hydrogen production by water splitting process and the study of its efficiency by the rotating Ring Disk Electrode method.

ParisTech School: Chimie ParisTech | PSL
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Lab location: Chimie Paris Tech
(Lab/Advisor website): https://www.ircp.cnrs.fr/
Short description of possible research topics for a PhD:Hydrogen energy is considered by the scientific community as one of the potential clean energy sources to replace the pollutant fossil energy. Therefore, the hydrogen production is becoming à hot topic in material science. The present PhD proposal will focus on the synthesis and electrochemical characterization of innovative semiconductor and transition metal materials (chalcogenide, oxide, mixed) for high efficiency of water splitting. The rotating Ring Disk Electrode (RRDE) method will be used to study the oxygen vs. chlorine evolution (OER vs. CER) in alkaline media. The objective of this study is to explore the efficiency of different materials for the competitiveness of both oxygen and chlorine evolution and the influence the transition metal catalysts. The optimized electrode materials will be integrated into new generation of electrolyzes for the electrochemical decomposition of water in the dark or under illumination which mimic the artificial photosynthesis (photoelectrochemical water splitting). This research aims to the development of low cost and active electrocatalysts for hydrogen fuel production efficiency. This work will be achieved in collaboration with Pr. Ahmed Ennaoui president of the scientific council of IRESEN (the Moroccan Research Institute for Solar Energy and New Energies)
Required background of the student: Solid State chemist, electrochemist, physical chemist
A list of 5 (max.) representative publications of the group: (Related to the research topic)

1. A. Ennaoui, and H. Tributsch, Journal of Electroanalytical Chemistry 204 (1986) 185
2. A. Ennaoui, and H. Tributsch , Solar Energy Materials and Solar Cells, 29 (1993) 289-370
3. A. Taleb, F. Mesguich, X. Yanpeng, C. Colbeau-Justin P. Dubot, Solar Energy Materials and Solar Cells, 148, 52, (2016).
4. S. Mehraz, P. Konsong, A. Taleb, N. Dokhane, L. Sikong, Solar Energy Materials and Solar Cells, 189 (2019) 254-262.
5. H. Ennaceri, D. Erfurt, L. Wang, T. Köhler, A. Khaldoun, A. El Kenz, A. Benyoussef, A. Ennaoui, A. Taleb, Solar Energy Materials and Solar Cells, 201 (2019) 110058.