

PhD position opening

Metallic nanoclusters embedded in nitride nanolaminates for efficient gas separation membranes

Hydrogen technology recently gained interest, as H₂ represents a serious clean energy carrier. Thus, H₂ separation and purification is of great importance, and new strategies for developing stable and H₂-selective membranes are urgently required. This project proposes an original approach through the development of new nanocomposites membranes that combine the stability properties of a nitride ceramic matrix, with the selectivity properties of metals used as matrix nanofillers. Atomic layer deposition (ALD) will be used as a unique technique to grow conformal nitrides thin films and metal nanoclusters, providing a fine control over the thickness and the clusters sizes. Rapid thermal processing will then be used in order to stabilize and tune their properties. Next, the yield of the synthesized membranes will be studied for H₂ separation/purification and for the separation/treatment of other gas mixtures. Finally, the upscaling capability and the industrialization of the newly developed membrane technologies will be assessed.

The research carried out at the Center for Interdisciplinary Nanoscience of Marseille, CINaM (around 180 persons), is multidisciplinary in background. Physicists, chemists and biologists but also geologists work together on defined topics in Nanoscience and Nanotechnology. The hosting group is specialist in electrochemical nanostructuring of surfaces and functionalization by ALD for energy applications. The PhD thesis is part of the starting ANR project MeNiNA in close collaboration with the European Institute of Membranes (IEM) and Annealsys SAS both located in Montpellier. The CINaM will provide expertise in the ALD process development, as well as the characterization of metallic clusters. The group, driven by Lionel Santinacci, has expertise in ALD of TiN, Pd clusters and the investigation of their morphology, crystalline structure and chemical composition. The CINaM facilities will be used for these tasks.

The PhD candidate will be expected to:

- perform the synthesis of TiN/Pd nanolaminates and explore other potential systems
- characterize the morphology, structure and composition of the nanolaminates
- participate in the assessment of the gas separation properties of the system in collaboration with IEM.

Location: The PhD student will be located at CINaM on the Campus of Luminy, Marseille.

Duration: 36 moths. The starting date is expected to be October 2018.

Profile: Excellent Master Degree in Chemistry or Physical Chemistry. In depth practical experience in surface science, material science. Highly motivated person with hands-on mentality and strong interest in experimental science. Work both independently and within a collaborative project framework to achieve project and group targets.

Supervisor: Lionel Santinacci (CNRS)

Funding: This PhD will benefit from the support of ANR.

Application: CV + letter of motivation + one or more reference contacts from former advisor/professor to be sent to L. Santinacci. There is no deadline for application but the position will be filled as soon as a solid applicant is identified.

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