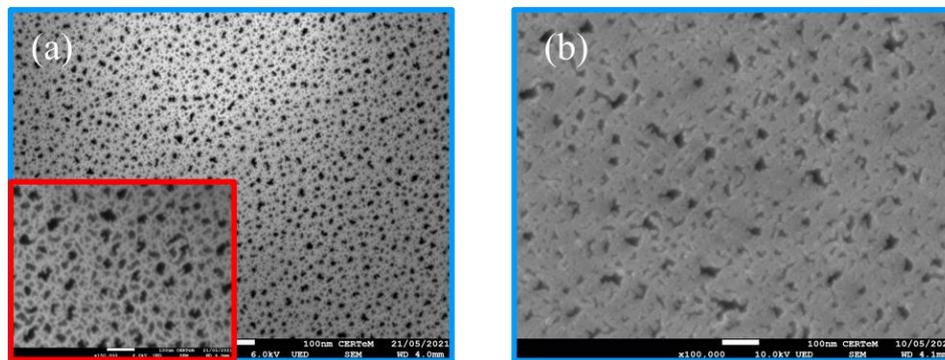


Synthesis and functionalization of porous silicon films by atomic layer deposited metal oxide

Lab & Context

GREMAN is a joint research laboratory of Tours University and INSA Centre Val de Loire in France. Our team works on topics related to porous silicon synthesis and its applications. Porous silicon is an interesting material currently used on research and development for numerous applications such as photonics, microelectronics or biotechnology. The laboratory is hosted in ST Microelectronics company's industrial site in Tours (France) and allows working in a relaxing but professional environment. Thanks to its integration into the CERTeM technological platform, access to cutting-edge equipment is guaranteed.

For many years, GREMAN has worked on porous silicon (thin films or particles) applications including electronic component development, biomedical applications or energy-storage devices [1]. In



Top view of porous silicon membrane before (a) and after (b) ALD material coating.

particular, recent work on atomic layer deposited materials coating porous silicon has shown promising potential for a new generation of micro-supercapacitors. In this context, the internship aims to determine the relevant experimental conditions to synthesize porous silicon and to functionalize it by means of ALD TiO_2 layer. Additionally, we will perform optical characterization in order to understand their potential for solar fuels production [2].

Objectives

The project is articulated in three main sections:

- **Synthesis and morphological characterization of porous silicon membranes.** Our team masters the procedure leading to porous film synthesis (by electrochemical etching). The intern will be in charge of the particle synthesis and thus will use the electrochemical cell to form porous silicon thin film. However, some preliminary tests need to be performed to ensure films' purity prior to the transfer into the ALD chamber. Moreover, he or she will also be in charge of the membranes' morphological characterization (SEM, granulometry).
- **Conformal coating of porous silicon films.** The student will be in charge of determining the adapted parameters for the deposition of the TiO_2 films before actually coating the porous substrate. SEM, TEM, EDS and XRD will then allow investigating the quality of the functionalization. Resulting samples might be sent abroad for deeper analysis.
- **Study of the optical properties.** In order to understand if these functional films have a potential as solar fuel chips, optical characterization of the films before and after coating

should be evaluated. It will allow determining the light-trapping capabilities of the films, the idea being to maximize it.

Profile

The intern must be **undergraduate or graduate**. Moreover, a background in the fields of **material science and/or electrochemistry** is also highly recommended. The internship will be **4 to 6 months** long and can start from February 2022. Net salary is about 550€/month and is not taxable.

Contacts

If you are interested in the internship or if you need any further information, please do not hesitate to contact us:

Brice LE BORGNE
Ma tre de Conf rences (Associate Professor)
Universit  de Tours
GREMAN – Site STMicroelectronics
16 rue Pierre & Marie Curie – BP 7155
37071 TOURS Cedex 2
brice.leborgne@univ-tours.fr

Ga l GAUTIER
Professeur (Full Professor)
INSA-CVL
GREMAN – Site STMicroelectronics
16 rue Pierre & Marie Curie – BP 7155
37071 TOURS Cedex 2
gael.gautier@univ-tours.fr

References

[1] <https://greman.univ-tours.fr/activities/porous-semi-conductor-546388.kjsp>

[2] J. Rong , T. Bosserez, D. Martel et al. Monolithic cells for solar fuels. *Chemical Society Reviews*, 2014, vol. 43, no 23, p. 7963-7981.