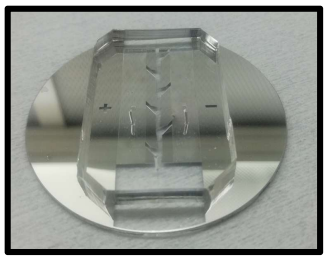
Bubble dynamics for hydrogen production

Proposal for a Master's internship 2 (4 à 6 mois), with the possibility to be followed with a PhD thesis.

Context :

In this collaborative project, we are looking at the production of H2 from the electrolysis of water. The aim is to optimise electrodes in order to generate massive H2 production in membrane-free electrolysers. In addition to ohmic losses, interactions between bubbles seriously affect the efficiency of dihydrogen production. We have shown that an ingenious electrode geometry enables the bubbles produced to be evacuated rapidly, i.e. before they interact with each other, and results in excellent purity (94%) with a low ohmic resistance (3 W). This innovative geometry was achieved by coupling a numerical model of bubble dynamics with a topological optimisation algorithm. Preliminary experiments show qualitative agreement between experiments and modelling.



Sujet proposé

Now that the validity of the approach has been demonstrated, it is necessary to generate other geometries numerically and evaluate them quantatively (study of the various stages in the life of a bubble: nucleation, detachment, bubble interaction dynamics; quantity of dihydrogen produced; purity of the hydrogen produced, etc.).
The aim of the internship will be to provide these quantitative analyses. The student will initially be familiarized with the numerical tool, microfabrication techniques and the carrying out of experiments. The student may be involved in data processing and discussions on the modeling of these systems. The internship may be followed by a PhD thesis.

Location:
Laboratoire IPR (Institut de Physique de Rennes) : https://ipr.univ-rennes.fr/
In collaboration with the laboratoire IETR : https://www.ietr.fr/

Supervision : T. MABIT (doctorant)., MC Jullien (DR CNRS), L. Courbin (CR CNRS), H. BEN AHMED (MCF)

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We are looking for a student in Masters 2 or final year of engineering school with a background in physics, mechanics or mechatronics, with an interest in fluid mechanics and energy applications.