

## Frustule incorporation effect on efficiency of solar cells

### Background

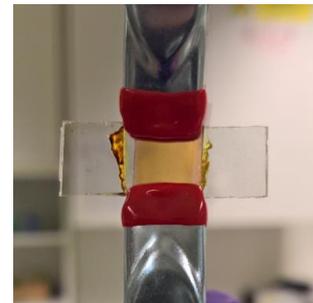
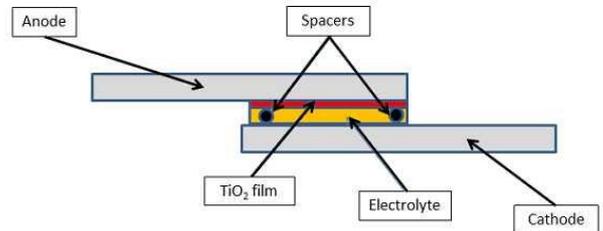
Solar cells have been subject to a growing interest and dye sensitized solar cells, due to their perspective of greener and cheaper fabrication methods are of interest, especially for low illumination environments. These cells as well as Si based cells can be improved by incorporating or covered by nanostructured materials. Diatoms are unicellular microalgae covered by hierarchically structured silica shells (frustules). The size, shape and nano-porous structure deeply influence the light transmission and the morphology of the solar cell.



The silica endoskeleton of a diatom is a few micrometer to half a millimeter in size and it contains a nanosized regular pattern.

### Problem description

The insertion of silica-based bio-formed nanostructures has shown an improvement of the performance in DSSCs [1]. The physical principles of the frustule action require further studies. The project is performed in cooperation with the Swedish Algae Factory which is delivering the bionanostructures obtained from diatom algae. The aim of the experimental work will be an improvement of the actual potential/current characteristics and the understanding of the nature of the mechanism of charge transfer in the cells. The investigation is done by electrical, dielectric, UV-Vis-NIR spectroscopic measurements and by SEM observations.



Example of assembling a solar cell using gel electrolytes.

The Swedish Algae Factory founded in 2014 and based at the Stena Center, Johanneberg campus, is processing the diatoms in its facilities, in Kungshamn,

### Requirements:

Study background in physics, chemistry or biotechnology.

### Experimental measurements:

Potentiostatic dielectric spectroscopy, XRD, UV-vis-NIR and IR spectroscopy. Different ways of assembling the complete photoelectrochemical cell will be tested.

[1] D.-R. Huang, Y.-J. Jiang, R.-L. Liou, C.-H. Chen, Y.-A. Chen, C.H. Tsai Enhancing the efficiency of dye-sensitized solar cells by adding diatom frustules into TiO<sub>2</sub> working electrodes Applied Surface Science 347 (2015) 64-72

### Contact persons:

Maurizio Furlani - f6bmauri@chalmers.se  
 Sofie Allert sofie@swedishalgafactory.com  
 Ingvar Albinsson - ialbin@physics.gu.se  
 Bengt-Erik Mellander - f5xrk@chalmers.se

### Location:

Fysik Forskarhus, room F6413, tel 0704332603