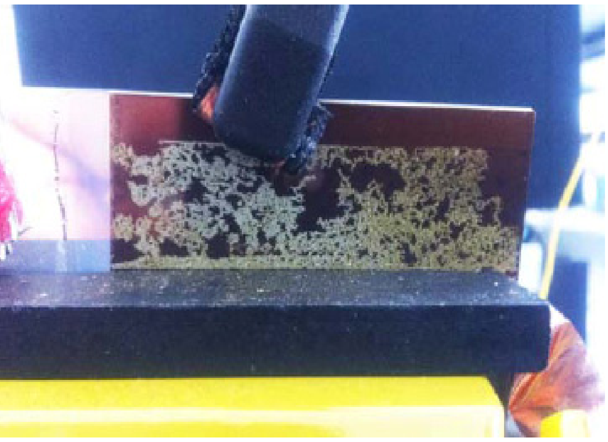

PYROCELL-ISYS

Electro-curing burn-out system for Fiber Matrix Pyrite solar cells

Project Summary

The overall objective is the achievement of a "diode kind" behavior of a full <p> pyrite / <n> ZnO heterojunction device ready for electronic characterization (current-voltage, spectral response, etc.) and further optimization. The optimization concerns the growth parameters of the pyrite fibers on one hand and an electrical post-treatment on the other. In the post-treatment, the junction is reversely biased in order to burn-out fibers that have ohmic behavior.

This part of the project focuses on achieving the electrical process which is needed to obtain good quality semiconductor and therefore improve the efficiency of these solar cells. The active part of the diode is formed of pyrite nano-fibers in a matrix of aluminum oxide (made by anodizing). The Fiber Matrix configuration offers the possibility to selectively cure the individual fibers. Indeed "bad" fibers which consist of non pyrite material can be selectively "burned" out (if they are metallic or degenerated pyrite) after the device is finished. If the fiber has high ohmic resistance, it will behave passive. Furthermore, this structure allows light-trapping as diffuse incoming light can be absorbed laterally by the pyrite fibers.

Valorisation

Although the ultimate goal of the project, namely obtaining a "diode kind" behavior on a so-called fiber matrix, has not been reached, a lot of progress has been achieved on the way to the pyrite solar cells. Indeed the creation of the fiber matrix took more time as expected and the implementation of iron in the nanopores has proven much more difficult than hoped. But on the other hand the conversion of iron into pyrite using the new reactor-concept (ICP) was the positive outcome. Indeed the presence of pyrite in trace quickly turned into a layer composed entirely of FeS_2 and which the content of pyrite is as high as 90%. Moreover the process to cure the non-semiconducting parts of the cell was successfully developed using ITO in Al_2O_3 pores whereby an electronic system containing a constant current density regulation was developed and should be ready for the treatment of real diodes.

With these excellent results some contacts were made with the industry, namely Oerlikon Solar Lab, who showed their interest to participate to the project follow up (contact Dr. Ulrich Kroll) based on CTI funding. Moreover discussions are ongoing with Helyssen to build a dedicated reactor with a design similar to a parallel plate reactor, but operating under an inductive principle. Thus all the advantages obtained with the ICP reactor are kept, while enabling large scale processing.

Specific issues such as template growth of iron into the Al_2O_3 templates or conversion of metallic sites such as grain boundaries to an insulator by a post-treatment, must be studied within a National Funds project. In summary the PYROCELL project funded by Gebert Ruef Stiftung had its most improtant impact in synthesis (HE-ARC) and precise confirmation of the progress based on X-RAY analysis (CSEM) This close interaction will be key for further progress in future projects.

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