PROJECT FACTSHEET

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NACHOS

NACHOS is dedicated to the development of new passivation contacts for silicon solar cells and characterizing them by new techniques for correlative nanoanalytics.

Inspiration

As green house gases concentrations and temperatures are soaring at an ever increasing pace as highlighted at recent COP21 conference, there is an urgent need to develop cheap but yet efficient renewable energy technologies. And in that regard, solar cells appear as one interesting solution to meet a significant share of the global electricity needs due to the abundance of the energy source: one hour of sunlight satisfies the global energy needs of one year. While the price of solar panels has been dramatically decreasing over the last few years, conversion efficiencies still fall short behind theoretical limits.

The most severe losses in crystalline Si cells, which have market share of 93% due to their low cost and hence low payback time, occur from charge carrier recombination at the metal electrodes, as these are traditionally prepared directly on the wafer. Recently, a novel contact scheme based on tunnelling oxide layer was presented, which addresses these recombination losses, while also being compatible with cost requirements.

Innovation

The contact scheme consists of a thin silicon oxide interface layer grown on the Si wafer, which passivates the electronic defects present at the wafer surface, while still allowing carrier transport. This layer is capped with a doped carrier-selective silicon-based layer that also acts as source of dopants, which diffuse into the wafer during a subsequent thermal annealing step to provide an additional field-induced passivation. While such cell design has resulted in cells with an efficiency in excess of 25%, further developments are hindered by analytical challenges. Indeed, conventional characterization techniques have difficulties in assessing the structure of contact at the nanometer scale, notably its crystallinity, the presence of pinholes through the thin oxide layer and the spatial distribution of dopants and hydrogen into the contact.

In that regard, the project NACHOS proposes to combine ex situ and in situ state-of-the-art transmission electron microscopy (TEM) and secondary ion mass spectroscopy (SIMS) techniques to yield a detailed understanding of how the nanostructure of the contact influences the macro scale optoelectronic properties of the contact. Then NACHOS project team will use these nanometer scale insights to design improved passivating contacts with additional functionalities. To achieve these objectives, the NACHOS project will involve complementary partners at EPFL and LIST who have expertise in passivating contacts preparation, their optoelectronic characterization, and structural and chemical analysis techniques by in situ TEM heating and novel spatially-resolved SIMS techniques.

Impact

NACHOS project should enable the development of novel contact designs that are easily adaptable to today's Si solar cell production lines and may hence provide a part of the solution to tomorrow's energy needs.

Partners

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