Abstract Submitted
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Modeling PECVD of photovoltaic silicon layers from hydrogen diluted silane ccrf discharges[1] DIRK BLUHM, STEPHAN DANKO, OLIVER SCHMIDT, Robert Bosch GmbH, Stuttgart, RALF PETER BRINKMANN, Ruhr-University Bochum — The dynamic photovoltaic market (especially for thin film technologies) demands massive cost reduction and efficiency increase. Plasma processes play a crucial role in various solar cell technologies. Desired high quality silicon films must be deposited fast and under stable process conditions. We use a commercial fluid model (CFD-ACE+)[2] to obtain spatiotemporal species densities and reaction rates. The chemical data set comprises of around 20 species and 80 chemical reactions. Densities obtained with a fast volume-averaged chemical model show good agreement with bulk densities from the fluid model. Care must be taken not to oversimplify chemical reaction mechanisms at pressures above 200 Pa, when polymerization processes become increasingly important. We study deposition regimes over a wide range of parameters, varying the pressure between 50 and 1000 Pa and allowing for high frequencies up to 95 MHz. Different heating mechanisms can be distinguished, leading to a different localization of radical generation. This is particularly relevant for asymmetric discharges. Process dependent radical composition and ion bombardment are analyzed, leading to design rules. Investigation of the ion bombardment by modeling the plasma sheath independently will be a subject of further research.

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[2]CFD-ACE+ User Manual, v2010.0, ESI Group, http://www.esi-cfd.com

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