UC San Diego

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Friday, May 25, 2018
9:00a.m.
SME 348

"Liquid Phase Epitaxy Doping for High-Performance Emitters in Silicon Solar Cells"

Abstract: Recombination in the emitter is a primary contributor to recombination current in modern industrial silicon solar cells. This loss is primarily due to recombination that occurs because of the inflexible constraints of solid-state diffusion kinetics during conventional emitter formation that result in a heavily-doped, difficult-to-passivate front surface. *P-n* junction formation by gas diffusion is also one of the costliest steps in the cell process due to equipment capital expenditure, the large thermal budget required, and the low-throughput batch nature of the process [1].

Liquid phase epitaxy doping (LPE-D) is proposed as a facile low-temperature, low-cost replacement for boron and/or phosphorus diffusion. This doping process decouples the emitter formation from the slow solid-state kinetics of gas diffusion. The doping profile formed is largely time-independent – theoretically, doping could be done in a brief firing step or during bulk impurity gettering, allowing throughput to be optimized without constraining cell architecture in next generation solar cells. The liquid phase epitaxy approach results in a nearly uniform doping concentration profile with the potential for lower saturation currents and improved surface passivation in comparison to existing and proposed industrial diffused emitters. We examine the performance of emitters doped via liquid phase epitaxy using simulation and present experimental demonstration.

Biosketch: Tulika Rastogi earned her B.Tech. degree in Chemical Engineering from National Institute of Technology, Rourkela (India) in 2014. She is currently pursuing a Master degree in Chemical Engineering at University of California, San Diego, working under the supervision of Professor David Fenning. Her research focuses on reducing the production cost of Silicon solar cells by introducing a new method of forming emitters on wafers. She has worked as a Quality Engineer (textile) in Trident Industries, India (2014-2016). She was also awarded Gandhian Young Technological Innovations (GYTI) Award for her work on application of nano-fibers for feminine hygiene products in Indian Institute of Technology, Hyderabad (2013).