Teaching Nanomanufacturing Principles Through a Concentrated Hands-on Solar Cell Fabrication Experience

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Abstract

The rapid rise of nanotechnology and its applications has established the field of nano/micro-electronics as a potential career path for current and future scientists and engineers. As such, there has been a growing need for current nanotechnology professionals and educators to develop materials, activities, projects and curricula that introduce basic concepts of the field, such as modeling, fabrication and testing, to a diverse audience. To help address this need, our group developed a highly-concentrated 10-day hands-on solar cell laboratory experience geared toward undergraduate learners. This talk presents the details of that cleanroom experience from design to fabrication to testing. In the fabrication stage, highly-doped p-type silicon <100> wafers are processed by photolithography and thermal oxidation to create the solar cell mask. The wafers are then doped with phosphorous through thermal diffusion, creating pn-junction diodes on the front side. Aluminum with 1% silicon is sputtered on the backside of the wafer to create an electrical contact, and then sputtered on and lifted off the front side to create electrical contact pads for each solar cell on the wafer. In the testing stage, the wafer is diced, and the individual solar cells are mounted onto a PCB (printed circuit board) with attached wire leads for testing. The solar cells can then be placed under a light source such as a solar simulator to measure their IV curves and efficiencies. The solar cell fabrication project gives learners an in-depth, hands-on experience in fabrication and testing that can serve as an introduction to micro/nanomanufacturing, cleanroom facilities and the principles of nanotechnology.

Biography of Presenter

Jerry A. Yang is a third-year electrical engineering honors student at the University of Texas at Austin. His current technical cores are integrated circuit design and nanotechnology. He is a student member of the Institute of Electrical and Electronics Engineers as well as the American Society of Engineering Education. At UT Austin, he has served as a teaching assistant in courses on digital logic, embedded systems and computer architecture. His engineering interests include micro/nanofabrication, MEMS systems, digital logic design, embedded systems and microcontrollers. His non-engineering interests include STEM/engineering education and LGBTQ+ studies.