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Novel Materials and Nanostructures for Photovoltaic Energy Conversion

ABSTRACT:

The world demand for, and consumption of, energy is dramatically increasing, with an increasing demand for renewable non-fossil based sources of electricity. As well, there is an ever growing demand for increased power and sophistication in the satellite systems orbiting our planet, driven by our increasing reliance on high speed communication and data links. The conversion of light from the sun into electrical energy, using photovoltaics, is one avenue that can be explored to meet these challenges both on the earth and in space, with III-V's being the most promising materials for very high efficiency devices. At RIT, our team's expertise lies in vapor phase epitaxy (VPE) of III-V photonic devices and nanostructures, bandgap engineering using epitaxial nanostructures, novel photovoltaic devices such as the intermediate band solar cell and potential routes for low cost high efficiency III-V multijunction devices. This talk will give an overview of PV research at RIT, a discussion of the nanomaterials approach and specific results using quantum dot (QD) superlattices, Sb-based photovoltaic materials development and finally some recent results on developing low-cost substrates for III-V materials. During the talk, we will show the effects of QD solar cell design on both absorption and open circuit voltage and discuss the nature of carrier escape and recombination paths inherent to QD solar cells. As well, we will discuss the growth and processing of an InAlAsSb alloy for photovoltaic applications as well as GaSb solar cells grown on GaAs using the interfacial misfit (IMF) technique. The last topic will include a cost breakdown of III-V photovoltaics and recent results using polycrystalline Ge as a template for growth of III-V solar cells.



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BIOGRAPHY:

Dr. Seth Hubbard is currently an Associate Professor of Microsystem Engineering and Physics at the Rochester Institute of Technology as well as serving as Director of the NanoPower Research Laboratory. Dr. Hubbard currently leads a team of six graduate students and three postdoctoral fellows working on the epitaxial growth, fabrication and characterization of nanostructured solar photovoltaic devices. He has received over \$5M in funded external research related to photovoltaic device development, has authored or co-authored over 70 journal and conference publications on electronic and photovoltaic devices and received an NSF CAREER Award as well as the RIT Trustee Scholarship Award. Dr. Hubbard also serves as an Editor of the IEEE Journal of Photovoltaics and is actively involved in the organization of the IEEE Photovoltaics Specialists Conference. Prof. Hubbard received his B.S. in Physics from Drexel University, his M.S. in Electrical Engineering and Applied Physics from Case Western Reserve University, and his Ph.D. in Electrical Engineering from The University of Michigan.