Compound Semiconductors for Energy Applications and Environmental Sustainability—2011

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Compound Semiconductors for Energy Applications and Environmental Sustainability–2011

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PREFACE

This volume contains a subset of Oral and Poster presentations that were made during Symposium D, "Compound Semiconductors for Energy Applications and Environmental Sustainability", at the 2011 MRS Spring Meeting held April 25-29 in San Francisco, California.

Compound semiconductors have long been an integral part of everyday life. Many of these semiconductors exhibit direct band gaps that are tailorable over a wide range of energy. This property can be leveraged for many energy-related applications such as efficient lighting, high-efficiency solar cells, and efficient switching. Recent progress on their potential as emitters, sensing devices in biological and chemical environments, and high efficiency power devices demonstrates their impact on conservation of energy and environment, and on mitigation of climate change. Compound semiconductor-based photovoltaic systems are emerging as an economical means of generating renewable energy through the use of concentrator technologies. The significant funding by various federal (e.g., Department of Energy's Sunshot Initiative) and state agencies as well as industry clearly signifies the importance of green energy and its role in supplementing and potentially replacing greenhouse-generating fuels.

Use of compound semiconductors such as the III-nitride family of materials has played the most significant role in the realization of solid state lighting as a viable means for potentially full replacement of the traditional means of lighting such as fluorescent and incandescent lighting. In order to fully realize this potential, fundamental scientific questions such as efficiency droop in green LEDs need to be addressed. Research into the use of III-nitrides for photovoltaic (PV) applications is also significant, attracting much attention as full-solar spectrum PV materials. InSb and CuInGaSe are also being researched as the major players in the PV field. Nanostructures based on these compound semiconductors show favorable properties such as more efficient collection and transport of carriers. Multijunction solar cells using InGaAs and InGaP are important players in space applications, where efficiency is the critical metric, but continued progress may make these contenders in the commercial marketplace.

These are only a few of the many examples of the significant role compound semiconductors will play in our energy future. Understanding the interaction of these compounds with their environment, including any potentially negative impact they may have on organisms and the natural environment, are other topics that need much research. This volume contains reports from internationally known experts on the state of compound semiconductor-based devices with applications to environmental conservation and energy use reduction, challenges associated with realization of such devices, and obstacles to their widespread use.

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