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Optical and Electronic Cooling of Solids

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Introduction

For the last 8 years, this conference was named Laser Refrigeration of Solids. In this period, the field has witnessed steady growth and we are now standing at the dawn of a new era which promises prototypes of laser coolers for real world applications. While laser cooling remains the only viable solid-state cooler technology to reach cryogenic temperatures, the community of thermoelectrics has been rapidly advancing in parallel. The year 2016 marks the first year of this conference under a new name, "Optical and Electronic Cooling of Solids," reflecting the fact that the meeting is expanding its coverage to include all solid-state bulk cooling technologies. We hope to see stronger interactions and development of device integration ideas between the two disciplines in the future.

This year's conference attracted an exciting collection of 25 invited, contributed, and poster talks showcasing advancements in the field, ranging from expanding scientific understanding of laser cooling and thermoelectrics to novel applications. The papers discussed novel results categorized in six sessions: Cryogenic Refrigeration in Rare-Earth-Doped Systems, Thermoelectric Coolers, Laser Cooling in Semiconductors, Novel Aspects in Optical Refrigeration I & II, and Applications and Device Concepts. The reported progress continued to expand the database of rare-earth doped cooling materials, in total comprised of ytterbium, thulium, erbium, holmium, and dysprosium active dopant ions in a variety of crystal and glass hosts, both in bulk and nanocrystal geometries. On the other hand, material science and advanced characterization methods have allowed for improvement of the quality of cooling solids to the point that operating temperatures of 90 Kelvin are now being reported by the University of New Mexico team. Liquid nitrogen temperatures may be within reach in the near future, and this progress motivates the multitude of advanced applications, ranging from basic science ones to space-borne sensor systems. Many of these applications were presented this year in a number of invited and contributed talks.

At the beginning of the session on thermoelectric coolers, the attendees enjoyed a comprehensive introduction to the field of Peltier and spin-caloritronics coolers given by Prof. Heremans, followed by interesting talks discussing novel advances in the field.

In parallel with the developments in cooling of insulator-based crystals, the field has witnessed active theoretical and experimental advances in optical refrigeration of semiconductors. First demonstrations of laser cooling of II-VI materials and record-breaking external quantum efficiency in III-V semiconductor heterostructures have marked milestone achievements in this direction a few years ago. This year's meeting elaborated on new strategies for increasing performance in laser cooling of semiconductors together with development of advanced methods of high precision characterization of materials.

Finally, we would like to take this opportunity to thank all members of the program committee and the SPIE staff for their help in organizing another very successful Optical and Electronic Cooling of Solids conference. Thanks to all the speakers, presenters, and participants for sharing their novel developments and new insights as well as active discussions, making 2016 another successful year for our conference.

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