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Colloidal Quantum Dots in Solar Cells and Lasers: Progress and Perspectives

Thursday 1 June 2017 08:00 (30 minutes)

Solution-processed nanomaterials offer low-cost alternatives to traditional bulk semiconductors. Recent breakthroughs have demonstrated electron mobilities and trap densities in solution-processed thin films on par with those of crystalline silicon.

In this talk I will discuss the research directions our group is taking using solution-processed nanomaterials for applications in optoelectronics, in particular solar cells, lasers, and LEDs, as well as perspectives and challenges in further improving their properties for specific applications.

Colloidal quantum dots have just reached 12% certified photovoltaic performance by using solution-based ligand exchange that reduces defect densities and improves carrier extraction. Further progress is expected as loss mechanisms are unveiled, and the origin of open circuit voltage deficit is understood.

Past year has seen the first implementation of a CW laser based on colloidal quantum dot thin films after more than a decade since the first gain and lasing were demonstrated in these materials. I will discuss how the understanding of electronic structure of quantum dots and its relation to optical gain motivated new chemical synthetic methods that allowed to bridge the gap between fs, ms and CW lasing.

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