CFEL SCIENCE

SEMINAR

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CFEL-bldg. 99, seminar room I (EG.076)

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Nanophotonics for energy applications: black silicon, invisible glass, and transparent metals

Recent advances in nanofabrication technology have enabled unprecedented control over the behavior of light at the nanoscale, allowing us to construct novel material architectures with precisely-tailored optical properties. In this talk, I will present three different nanostructured materials and their applications in solar energy conversion. Firstly, I will discuss self-assembled surface nanotextures with sub-50 nm feature sizes that can impart broadband and omni-directional antireflection to polished silicon surfaces. By implementing the theoretically-optimal refractive index taper in dense arrays of nanoscale cones, we are able to reduce surface reflections from silicon solar cells to less than 1% over the entire visible spectrum, even at large angles of incidence. Secondly, I will describe how creating such antireflective nanotextures on both the front and rear surfaces of a glass slide results in extremely high transmission (> 99.6 %), which renders the glass practically invisible. Glass treated in this manner provides an immediate benefit for a solar cell encapsulation layer that does not degrade the device performance. Finally, I will demonstrate that, by harnessing the excitation of surface plasmons in nanostructured metal films, we can construct material architectures that are simultaneously optically transparent and electrically conducting, out-performing indium tin oxide as a material for solar cell electrical contacts.

Host: Franz Kärtner, CFEL UX Seminar