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Plasma produced nanocrystals for efficient nanocrystal light emitting devices[1] REBECCA ANTHONY, KAI-YUAN CHENG, RUSSEL HOLMES, UWE KORTSHAGEN, University of Minnesota — Low temperature plasmas are a unique source for the synthesis of silicon nanocrystals. While silicon in its bulk form is a poor optical emitter, rather efficient emission has been demonstrated with plasma produced nanocrystals. Quantum yields for photoluminescence exceeding 60% can be achieved with proper surface functionalization of the silicon nanocrystals. In this presentation, we point out that the surface coverage with hydrogen plays a crucial role for the photoluminescence quantum yield. Hydrogen coverage is a direct consequence of the plasma synthesis, since nanocrystals are exposed to a constant flux of atomic hydrogen during their growth in the plasma. While efficient photoluminescence of silicon nanocrystals has been demonstrated in the past, achieving efficient electrically pumped luminescence has been a challenge. In this work, we have incorporated plasma-produced silicon nanocrystals into a hybrid organic-silicon nanocrystals light emitting device. Through optimization of the device structure, we have been able, for the first time, to achieve electrically pumped luminescence that approaches the intrinsic limit of the device structure, at which the external quantum efficiency is only limited by the photoluminescence quantum yield of the nanocrystals and the photon outcoupling efficiency.

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