All-inorganic nanocrystals boost infrared emission

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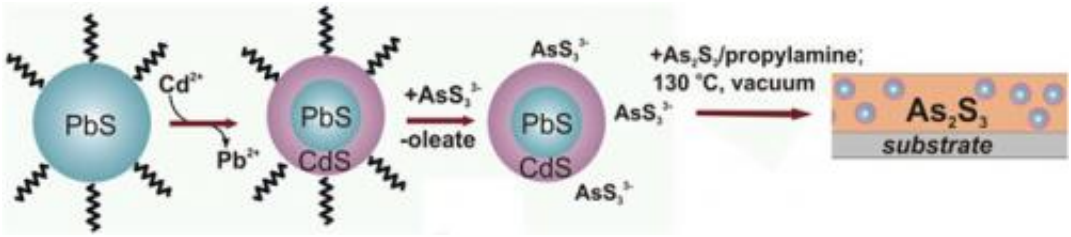

Synthesis of all-inorganic infrared-emitting PbS/CdS nanocrystals and integration into infrared-transparent As2S3 chalcogenide glass matrix

New chemistry has been developed to integrate lead chalcogenide nanocrystals into continuous inorganic matrices of chalcogenide glasses. Inorganic capping, rather than conventional organic capping ligands, allows simple and low-temperature encapsulation of these nanocrystals into solution-cast infrared (IR)-transparent amorphous As_2S_3 chalcogenide matrices. The resulting all-inorganic thin films display stable infrared luminescence in the technologically important near-IR region.

Conventional methods for synthesizing nanocrystals include capping them with long-chain organic molecules to control particle size, morphology, and stability. But molecular vibrations associated with those ligands sap the particles' excitation energies, reducing IR emission efficiency and stability.

In a wholly unique approach, the research team devised a solution-phase method for making core/shell nanocrystals in which conventional organic groups are replaced with inorganic As_2S_3 ligands. These all-inorganic particles are then mildly heated to convert the ionic ligands to an IR-transparent As_2S_3 matrix. Low-temperature integration of nanocrystals into transparent inorganic matrices is an important step for their optical and optoelectronic integration The new data suggest that dielectric screening is the major cause of slow radiative rates in conventional lead chalcogenide nanocrystals. Effective integration reduces the dielectric contrast and enables fast radiative rates. This is especially useful for nanocrystals emitting in the IR region where few host materials can provide good optical transparency.

More information: M.V. Kovalenko et al., " Inorganically Functionalized PbS-CdS Colloidal Nanocrystals: Integration into Amorphous Chalcogenide Glass and Luminescent Properties," *J. Am. Chem. Soc*, 134, 2457-2460 (2012) (online)

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