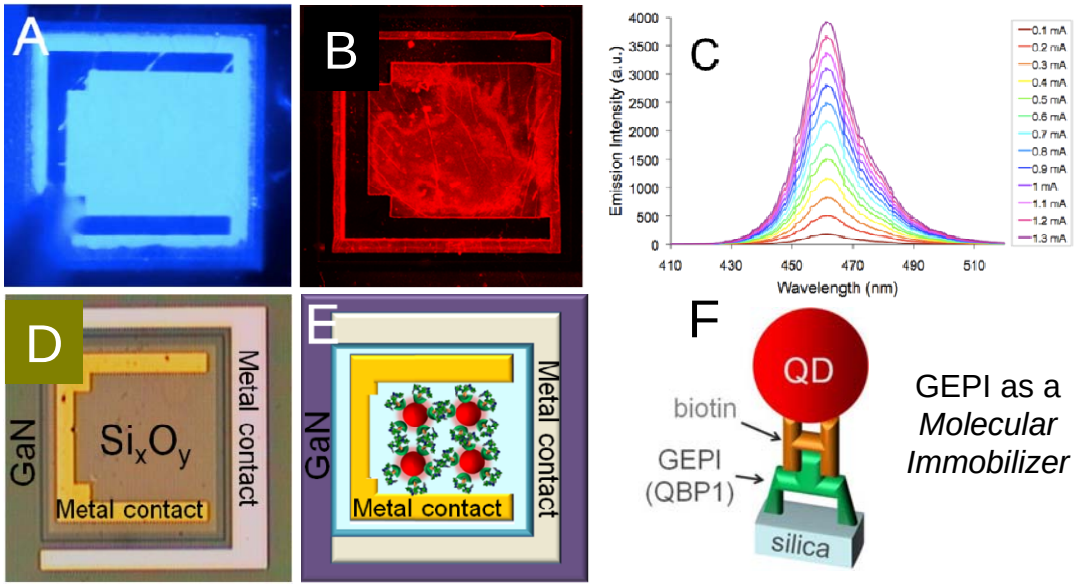
RESEARCH

Spatially Selective Assembly of Quantum Dot Light Emitters in an LED via Engineered Peptides

Semiconductor nanocrystal quantum dots (QD) are utilized in numerous applications in nano- and biotechnology. In device applications, where several different material components are involved, QDs typically need to be assembled at explicit locations for enhanced functionality. Conventional approaches cannot meet these requirements where assembly of nanocrystals is usually material-nonspecific, thereby limiting the control of their spatial distribution. Here we demonstrate directed self-assembly of QD emitters at material-specific locations in a color-conversion LED containing several material components including a metal, a dielectric, and a semiconductor. We achieve a spatially selective immobilization of QD emitters by using the unique material selectivity characteristics provided by the engineered solid-binding peptides (GEPI) as smart linkers. Peptide-functionalized QDs exhibited several orders of magnitude higher photoluminescence compared to the control groups. This work potentially opens up novel ways to advance photonic platforms in applications ranging from chemical- to bio-detection as well as novel nanodevices.*



GEPI as a *Molecular Immobilizer*

(A) DF Image, (B) Electroluminescence, and (C) Profiles at 462 nm at various levels of driving current at room temperature. (D) Plan view of the fabricated LED device with micro-architectured metal, semiconductor, and dielectric regions (light optical microscopy) and (E) its schematics, showing the (QBP1-bio)/(SA-QDot) hybrid construct targeted assembled only on the silica regions of the device. (F) The GEPI construct.

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