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New Type of Core-Shell Nanocrystal Quantum Dots for Applications in Light Emitting Diodes (LEDs) B.N. PAL, S. BROVELLI, Y. GOSH, V.I. KLIMOV, J.A. HOLLINGSWORTH, H. HTOON, LANL, CHEMISTRY DIVISION TEAM, CENTER FOR ADVANCED SOLAR PHOTOPHYSICS TEAM, CENTER FOR INTEGRATED NANOTECHNOLOGIES TEAM — We demonstrate a proof of principle for LEDs based on giant nanocrystal quantum dots (g-NQDs). These dots consist of a CdSe core overcoated with a thick CdS shell built one monolayer at a time. Our device structure is composed only of a PEDOT:PSS coated indium-tin oxide (ITO) anode and a LiF-Al cathode. These simple devices exhibit a maximum external quantum efficiency (EQE) and luminance of 0.12% and 1000 Cd/m2 respectively when 16 shell g-NQDs are used for the active layer. This performance is already comparable to that of more sophisticated all-inorganic NQD LEDs. Thick shell (>13 monolayer) g-NQD devices show EQEs about one order of magnitude higher than those of thin-shell (4 monolayer) NQD devices, as well as much greater stability for operation under ambient conditions. Although current g-NQD devices do not set any new performance records, this work demonstrates a significant potential of g-NQDs for LED applications.

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