Electroluminescence from Surface Oxidized Silicon Nanoparticles Dispersed Within Poly(9-Vinyl Carbazole)

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Research Summary:

- Electroluminescence (EL) from quantum confined crystalline silicon nanoparticles (Si nps) randomly dispersed within Poly(9-Vinyl Carbazole) (PVK) was obtained. The Si nps were fabricated in a nonthermal plasma, passivated ex-situ with a thin UV photooxidized shell, and dispersed in PVK using solution processing.

Major Observations:

- PVK(Si/SiO_2) EL (FIG. 1) was composed of simultaneous emission from PVK and Si/SiO_2 nps. The device emission was nonscalar with increased current density shifting from PVK to Si/SiO_2 np dominant emission (FIG. 2).

FIG. 1

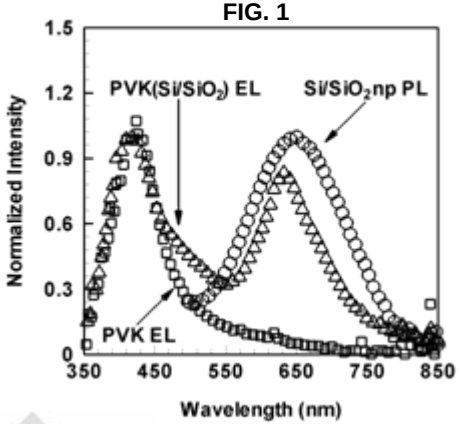
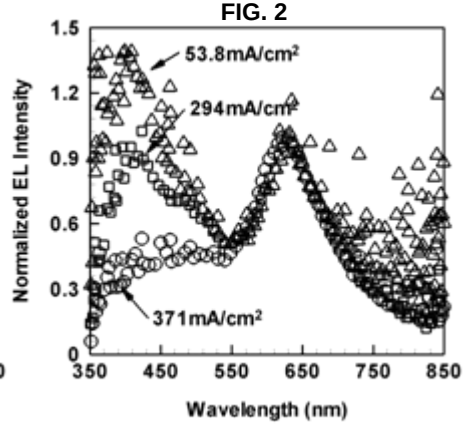


FIG. 2



Research

- The device JV response was bulk dominated, independent of the np loading (FIG. 3). However, the Si/SiO_2 nps affected the carrier transport properties of the PVK films by increasing current density and reducing device turn on voltage (FIG. 4).

FIG. 3

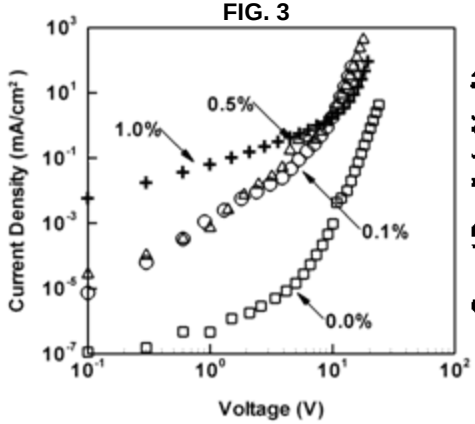
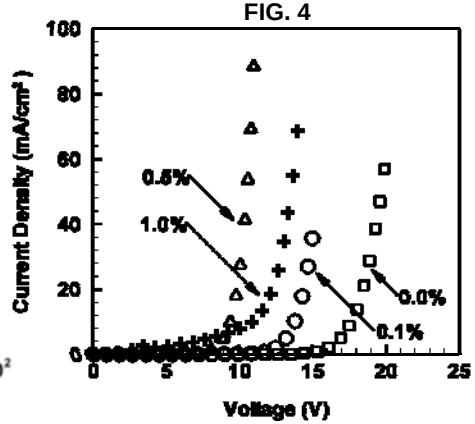


FIG. 4



Major Conclusions:

- Nonscalar EL field dependence and bulk dominated carrier transport properties strongly suggest the observed Si/SiO_2 np EL was produced by direct carrier injection.

Publications:

- *Appl. Phys. Lett.* **90**, 061116 (2007).