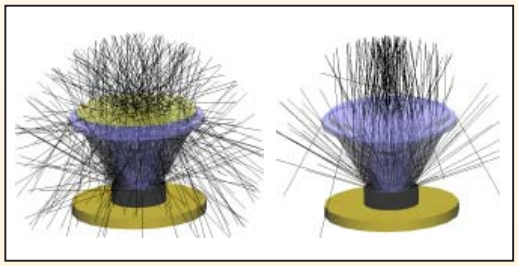
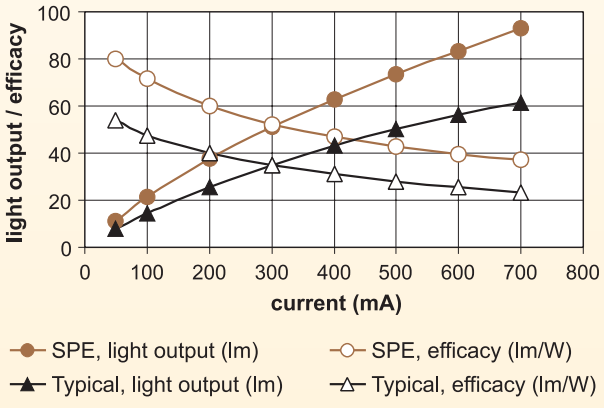
‘SPE’ Method Enhances White LED Light Output

Commercial white LEDs combine a light-emitting semiconductor with a phosphor (a rare earth compound) to produce visible white light. The nature of most phosphors, however, causes more than half of the light, or photons, generated by the phosphor to divert back toward the semiconductor die, where much of it is absorbed and lost. This scattering reduces the LED’s overall light output.

LRC researchers have developed a scattered photon extraction (SPE) method to improve the light output and efficacy of white LEDs. The SPE method combines optimally shaped optics and placement of the phosphor away from the die. This configuration allows light traveling back toward the die to escape through the sides of the optics, generating 30 to 60 percent more light output (lumens) and luminous efficacy (lumens per watt of electricity) than typical white LEDs. At low operating currents, the new SPE LEDs are able to achieve an efficacy of more than 80 lumens per watt (lm/W). The industry’s goal is to achieve 150 lm/W by 2012. Moreover, moving the phosphor layer improves LED life.

Top: **An LRC graduate student evaluates an SPE-LED fixture in the sphere.** ***Bottom:*** **Optical ray-tracings show the paths of light exiting the SPE LED (left) and a typical LED (right).**





Light output and efficacy of an SPE LED and a typical LED as a function of current. At low currents, the SPE LED produces 80 lm/W.

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