

Solid state lighting

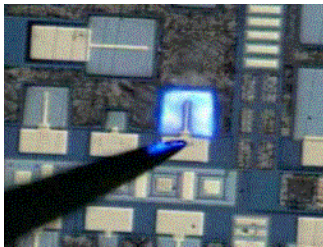
Michael S. Shur

Rensselaer Polytechnic Institute, U.S.A.

Today, 21% of energy use is in lighting, and, perhaps, half or more of this energy can be saved by switching to efficient and cold solid-state lighting sources. Solid-state lighting will use visible and UV LEDs that are projected to reach lifetimes exceeding 100,000 hours. From traffic lights to road signs, from automobile taillights to outdoor displays, from landscape to accent lights, solid-state light sources have already arrived as harbingers of the next lighting revolution.

The creation of efficient sources of white light is the ultimate goal of the solid-state lighting technology [1]. The efficiency of white LEDs using conversion of blue or UV light in ionic phosphors has already reached 160 lm/W [2]. This efficiency is 11.5 times higher than that of an incandescent lamp (13 lm/W), 1.7 times higher than that of a fluorescent lamp (90 lm/W), and even higher than that of a high pressure sodium lamp (132 lm/W),

Multicolor LED modules producing white light could achieve even higher efficiency, and optimization of such multi color LED modules is one of the most important problems of the emerging solid-state lighting technology. Solving this problem has allowed us to design and build versatile solid state lamps with adjustable spectrum used for treating seasonal affective disorder [3], growing plants [4], and evaluating color rendering [5]. Such solid state lamps that maintain constant user-selected spectrum via computer control will also find many other special and medical applications.



Blue LED on Si (courtesy of SET, Inc.)



Edison bulb (1879)



Versatile solid state lamp

1. A. Žukauskas, M. S. Shur, and R. Gaska, *Introduction to Solid State Lighting*, New York: John Wiley and Sons, 2002 [ISBN: 0471215740].
2. See http://www.eetasia.com/ART_8800437902_480700_NP_423faaf5.HTM
3. A. Žukauskas, R. Vaicekauskas, F. Ivanauskas, *et al.*, "Quadrichromatic white solid state lamp with digital feedback", *Proc. SPIE* **5157**, 185(2004).
4. G. Tamulaitis, P. Duchovskis, Z. Bliznikas, *et al.*, "High-power LEDs for plant cultivation", *Proc. SPIE* **5530**, 165 (2004).
5. R. Stanikunas, H. Vaitkevicius, A. Svegza, *et al.*, "Color perception under illumination by quadrichromatic solid-state lamp", *Proc. SPIE* **5530**, 347 (2004).