



The Search for Efficient Light Emitters: Past, Present, Future

Claude WEISBUCH

SFP Société
Française
de Physique

*Materials Department, University of California, Santa Barbara, California, USA
Laboratoire de Physique de la Matière Condensée, École Polytechnique,
CNRS, Institut Polytechnique de Paris*

We recall the evolution of lighting technologies throughout the ages, and how the demand for improvements was such that any new technology giving better and cheaper lighting was immediately implemented.

Electroluminescence – the phenomenon by which LEDs directly convert electricity into light – took some time to impact the lighting market. It was long thought to only be of use for indicators, flat panel displays, etc. LED lamps for general lighting only emerged recently as the dominant application of LEDs thanks to dramatic decrease in cost, and continuous improvements of color quality and energy conversion efficiency. This revolution aims at 60%+ reduction in electricity consumption for lighting.

We discuss the physics which leads to LED performance (LEDs with their 90%-range wall-plug efficiency remain more energy-efficient than lasers in spite of the latter relying on stimulated emission) and the remaining challenges for LEDs (efficiency drop at high current injection or at long wavelengths).

A long-standing challenge is the tantalizing possibility to obtain electrical efficiencies above 100% by scavenging thermal energy from the environment, similarly to heat pumps. It was observed very early, in the 50'ies, that the energy of emitted photons could be



larger than the energy supplied by the electrical source to the recombination species. It however raises a contradiction about transforming the energy supplied by the heat reservoir of the LED environment into light, eventually contradicting the second principle.

Séminaire SFP

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CONTACT :
Lise-Marie Lacroix