Field-Emission Lamp (FEL) Project

Jonathan Marrs, Charles Hunt, Sushma Shrinivasan, Claudio Lopez
Department of Electrical and Computer Engineering
University of California, Davis

Objective

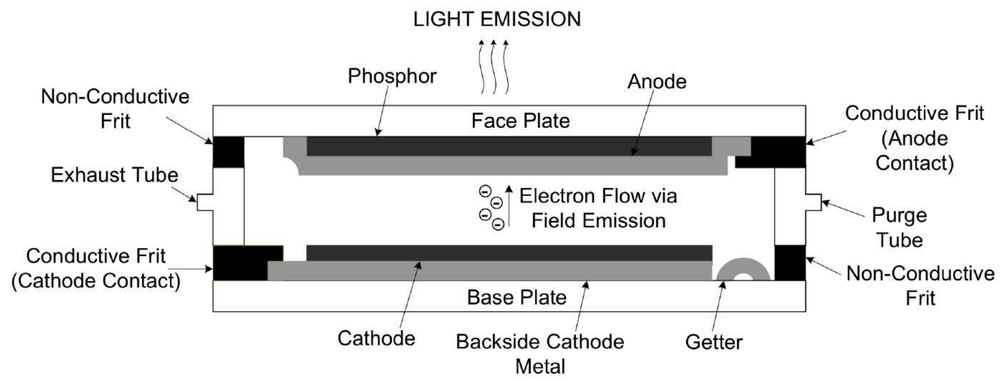
The objective of this research project is to create Field-Emission Lamp (FEL) prototypes in the most-desired lighting form factors.

A19 R30

2’ x 4’ Ceiling Luminaire

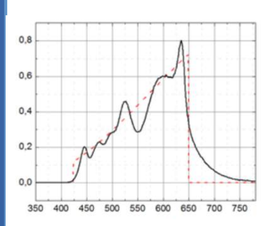
Field-Emission Lamp (FEL) Technology

The operation of a Field-Emission Lamp (FEL) is similar to that of a cathode ray tube (CRT), in which an electron gun uses high voltage to accelerate electrons which in turn excite phosphors to produce light, all within a vacuum environment. Unlike other energy-efficient light sources, FEL technology is inexpensive, environmentally friendly (no mercury), and has superior light quality.

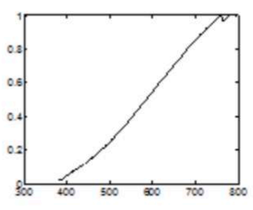


Phosphor Selection and Light Quality

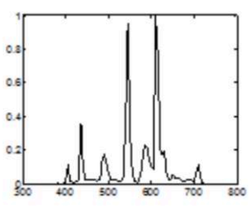
The FEL prototypes are high-color-quality, efficient light sources with natural-appearing spectral content. To optimize the efficiency and light quality, many different phosphor screen samples are created and measured to determine the best phosphor mixture and deposition process. By selecting an ideal combination of red, green, and blue TV phosphors, the FEL light spectrum is designed to closely resemble that of sunlight or incandescent light bulbs.



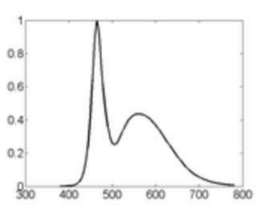
Field-Emission Lamp (FEL)



Daylight/Incandescent



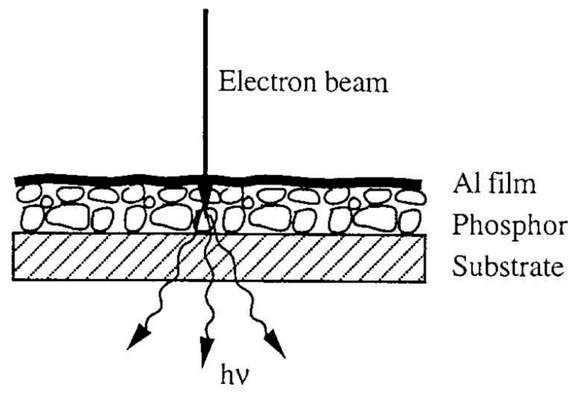
Fluorescent



LED

Phosphor Deposition and Measurement

The phosphor is deposited on a glass substrate using liquid gravity settling or by spin-coating a phosphor slurry. After drying, a lacquer is applied on top of the phosphor, which assists with the deposition of a thin, planar aluminum film. After the lacquer is removed/ charred in a furnace, the samples are tested for spectral content and luminance in a phosphor test vacuum system.



Phosphor Test Vacuum System

The phosphor test vacuum system allows rapid prototyping and testing of phosphor screen samples.