Full-Color Polymer Light-Emitting Diodes (07-052)

Polymer Collioid-Based Organic Light-Emitting Diodes can be Manufactured in a Wide Variety of Colors

Market Overview

These polymer organic colloid-based light-emitting diodes can be manufactured with different types of electroluminescent dyes, creating diodes that can emit a single color or the full spectrum for white light. In 2016, the global light-emitting diode market was worth $28.89 billion. This market is expected continue grow quickly due to decreasing cost of diode manufacture, increase in demand of energy conservation, and technology advancements in the screen backlighting market. Clemson University researchers have developed electroluminescent dye-containing colloids fabricated using mini-emulsion methods to create individual dye-doped colloids that emit in the red, green, and blue regions of the visible light spectrum and can be mixed to achieve a secondary color and white light. This system is advantageous over current methodologies due to its simplicity, color customizability, and scalability using conventional printing

Technical Summary

This technology is based on electron transport material technology and integration of appropriate red, green, and blue dye molecules into polymer colloid particles. Using a miniemulsion method, it is possible to create individual colloidal particles that emit in the desired ranges of the visible spectrum, which facilitates customization of performance for a desired application. Upon mixing of the three dye-doped particle suspensions, single secondary color and white light electroluminescent devices have been effectively demonstrated with no appreciable energy transfer between dye molecules. The device consists of a single emissive layer deposited between an optically transparent anode and a reflective metal cathode. Tailoring the system to a particular light wavelength involves simple mixing of the red, green, and blue colloid suspensions; i.e., to create an orange emitting device, the red and blue colloidal suspensions would be mixed to predicated ratios for the desired color emission.

Application

Electroluminescent devices, automotive lighting, decorative lighting, printable inks

Development Stage

Pilot-scale prototype

Advantages

- Colliod configuration of polymer controls color-mixing, allowing for emission of secondary color and white light.
- Organic base reduces power consumption and cost to manufacture, decreasing overhead costs and increasing profits.
- Customizability of the polymer allows for multiple materials and dyes to be used, allowing for specialty applications in a wide range of technology-related fields.

App Type	Country	Serial No.	Patent No.	CURF Ref. No.	Inventors
Utility	United States	NA	US 8,003,008	07-052	Dr. Stephen Foulger

About the Inventor

Dr. Stephen Foulger

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Dr. Stephen Foulger earned his Ph.D. from the Massachusetts Institute of Technology in 1996. Dr. Foulger is a senior member of the Department, having been a member since its founding, and has served as one of its leading innovators. His research focuses primarily on polymer physics, colloid synthesis, biomedical contrast colloids, intrinsically conductive polymers, and protein separation of nanoparticles.

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