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Organic Molecules with Delayed Fluorescence for Human-Centric Lighting and Radiation Detectors

Category: Lighting Technology and Material Science

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Summary

Utilizing a blend of molecules that exhibit delayed fluorescence and a photopolymer resin, this technology creates light converters that produce white light that approximates daylight so closely that it has surpassed all currently available devices. These light converters are operated in a way that offers a solution perfectly suited for applications requiring circadian and human-centric lighting that is stable, high-yield, and energy-efficient. This technology is adaptive to various daylight conditions including weather, time of day, and latitude, and if implemented, those spending most of their time in artificial lighting could receive immense health benefits. This invention's utility is underscored by its theoretical ability to be utilized for all indoor lighting systems, resulting in an expansive range of potential applications.

Development Stage

Prototype complete and tested.

Problem Statement & Solution

Light is an essential component of human life, and artificial lighting has evolved over thousands of years. Currently, six billion people worldwide have access to electric lighting, and 90% of the United States population spends under three hours with exposure to natural light every day. Previous research had shown that there are adverse health effects that come with using even what is considered our most efficient LED lighting technology. Electric lighting can cause disruption to the circadian rhythm, visual fatigue, tiredness, and depression. The materials used to produce conventional technology are also toxic and rare, causing a negative environmental impact.

Researchers at the Georgia Institute of Technology have developed a light converter using thermally activated delayed fluorescence (TADF) molecules that mimics natural daylight so closely that the differences are visually imperceptible. The utilization of this invention reduces circadian rhythm disruptions and visual fatigue associated with poor lighting, thereby improving mood and psychological state.

Advantages

- Closest approximation to natural daylight across visible wavelengths
- Adaptive to various daylight conditions including weather, time of day, and latitude
- High color fidelity and gamut index, ensuring high quality illumination
- High efficiency ensuring low carbon footprint
- Stable, high-yield, and energy-efficient light source
- Potential for thin, flexible, and scalable manufacturing

Commercial Applications

- Indoor lighting solutions for homes, offices, factories, and vehicles
- Hospital and school lighting systems
- Airplane cabin illumination
- Lighting therapy devices for treating seasonal mood disorders
- Smart lighting applications integrating electronic control, networking, and automation

Lead Inventor: Bernard Kippelen, PhD

Intellectual Property Status: US Patent applied for

Scientific Publication(s): Publication in Press