INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

Self-healing photochromic elastomer composites for wearable UV-sensors

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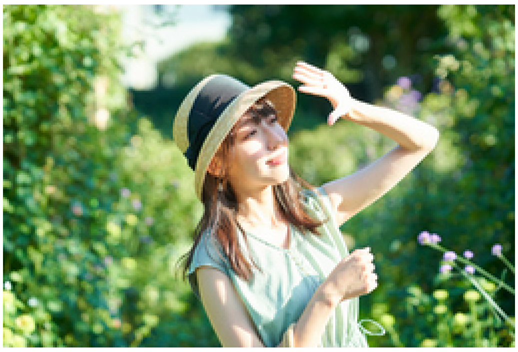

OVERVIEW

Photoelectric elastomer composite that defines a safe UV exposure by skin type

- Permits programmable UV sensitivity that displays a physical color change
- For environmental monitoring, food security, smart packaging, and wearable applications

BACKGROUND

Ultraviolet (UV) light is a type of electromagnetic radiation that can be generated naturally or synthetically and that can be either potentially beneficial or harmful. Synthetic UV light is utilized in the healthcare industry for disinfection, production of vitamin D, and phototherapy. Industrial manufacturing processes employ UV light for processes such as 3D printing, photocuring of polymers, and laser micromachining. However, overexposure to UV light can be harmful to human health, including eye damage, skin damage, and immune system suppression. Therefore, monitoring of UV light exposure is essential to ensure safe protection and to avoid UV-derived health problems. Most existing UV-sensors are electronic solid-state devices which are typically rigid and fragile, limiting their portability and usefulness. Newer UV-sensor designs undergo a color change upon UV light exposure due to photoreactions of functional groups in their molecular structures or charge transfer. These photochromic sensors hold great promise in this setting, though a need exists for devices that are durable and flexible in their applications.

INNOVATION

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Category
Materials
Life Sciences

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Researchers have invented a photochromic elastomer composite that is self-healing and which provides a sensing platform that defines a safe UV exposure threshold for different skin types. These self-healing photochromic polyurethane elastomer composites (photoPUSH) exhibit programmable sensitivity to UV light, displaying a visual color change through photoreduction without requiring additives, as well as excellent durability to mechanical stress, water-resistance, and healing efficiency (>97%). This material system is soft, portable, and permits multimaterial UV-sensing scratch-resistant sensor stickers and skin-mounted, textile-mounted, and smart wristband wearable devices. The unique dynamic properties of the polymer network enable multiple synergistic functions in the UV-sensing composite, including: (i) photochromism via electron donor groups without requiring additional dopants, (ii) stretchability and durability via elastomeric properties, (iii) healing of extreme mechanical damage via dynamic bonds, and (iv) multimaterial integration via adhesive properties. The device may therefore be applied to new soft sensor designs in portable environmental monitoring, food security, smart packaging, and healthcare wearable technology.