

Materials for Autonomous Tracking, Guiding, Modulating, and Harvesting of Energetic Emissions

Tech ID: 28998 / UC Case 2017-704-0

SUMMARY

UCLA researchers in the Department of Materials Science and Engineering have developed a novel photo-responsive polymer that can real-time detect, track, modulate, and harvest incident optical signals and a broad range of energetic emissions at high accuracy and fast response rate.

BACKGROUND

The capability of efficiently and simultaneously detect, track and harvest or modulate signals (e.g. optical, electromagnetic, and acoustic) are vital for a broad range of optics, photonics, optoelectronics and also national-security technologies. Current state of the art relies on tuning the physical properties of the surface materials or employing electronics and computer programmed systems, which lack of the ability of adaptively interacting and engaging with the signals. Waveguides can direct the signals but are normally cm-scale, rigid and heavy made of metallic materials. Current dominant technology that can both detect and follow the signal uses the MEMS-based or pre-programmed electronics to lift and tilt the entire heavy photo-detecting panel or fold the electromagnetic-receiving antenna towards the incident signals. It combines the discrete processes of sensing and actuation at high fabrication and operation costs.

INNOVATION

UCLA researchers have created the first-of-a-kind soft, light-weighted and micron-sized artificial phototropic material. The photo-responsive polymer can detect, track, modulate, and harvest incident optical signals in real time with high accuracy. The system can have a variety of response behaviors by tuning the type and amount of the absorbers. It can also have versatile applications by incorporating different components. Remarkably high efficiency in solar energy harvesting at various incident angles have been achieved, which effectively and efficiently minimized the incident angle-induced energy loss, for example, as the sun moves across the sky during the day. Furthermore, this material system has significantly enhanced the water evaporation efficiency in desalinization and distilled water generation applications. The efficiency of pure water production from wastewater or seawater has outperformed the reported solar vapor generation-based water distillation technologies to date, presenting the potential of being the next-generation, high-efficiency water purification technology.

APPLICATIONS

- ▶ Maximizing photon harvesting in low light condition for solar panel or fuel cells
- ▶ Light control in smart window
- ▶ Detectors capable of working at low light conditions
- ▶ Absorbers with selected response frequency ranges
- ▶ Soft variable-angle micro-waveguides and/or modulators
- ▶ Angular-definitive, self-adaptive photonic absorber/selective filter
- ▶ Self-adaptive, wavelength-independent, and polarization-independent optical diode
- ▶ Detectors for various signals if different components incorporated (e.g. acoustic/magnetic-electro-mechanically responsive)

ADVANTAGES

- ▶ Fully autonomous and high energy efficiency
- ▶ Integratable, easy and low-cost fabrication
- ▶ Fast response (at the time scale of 0.5-60 seconds)
- ▶ High-accuracy, real-time tracking, harvesting, and directing of optical or other signals

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OTHER INFORMATION

KEYWORDS

soft material, detect, track, modulate, harvest, signal, real-time, phototropism, responsive polymer, photo-thermal conversion, thermal-mechanical conversion, -plasmon resonance, waveguide, light-adaptive bending

CATEGORIZED AS

- ▶ **Optics and Photonics**
 - ▶ All Optics and Photonics
- ▶ **Materials & Chemicals**
 - ▶ Nanomaterials
 - ▶ Polymers
- ▶ **Nanotechnology**
 - ▶ Materials
- ▶ **Sensors & Instrumentation**
 - ▶ Other
 - ▶ Scientific/Research

RELATED CASES

2017-704-0

▶ μ m-mm level, soft, light weighted

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,572,470	02/07/2023	2017-704

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

▶ [Photo-induced Metal Printing Technique for Creating Metal Patterns and Structures Under Room Temperature](#)

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