

## Article

## High-Performance Circularly Polarized Light-Sensing Near-Infrared Organic Phototransistors for Optoelectronic Cryptographic Primitives

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## Abstract

Chiral photonics has emerged as a key technology for future optoelectronics, such as quantum information and encryption, by making use of photonic waves from enantiomeric structures. An inevitable challenge for realizing such chiral optoelectronics is the development of near-infrared circularly polarized (NIR CP) light-sensing photodetectors that convert optical power and circular polarization direction into distinguishable electrical signals. Herein, a simple and promising strategy for high-performance NIR CP light-sensing organic phototransistors (NIR CPL-OPTRs) applicable to highly secure optoelectronic encryption is proposed. By directly assembling a standalone cholesteric liquid-crystal network film in a thin-film NIR CPL-OPTR, remarkable responsivity and distinguishability are achieved. The synergetic effect of amplification of the photocurrent signal by the applied electric field and improved light absorption by the reduced reflection in the multilayered structure leads to high responsivity. As a proof-of-concept, the chiral phototransistor arrays are demonstrated as a physically unclonable function device and exhibit enhanced cryptographic characteristics. High-performance near-infrared circularly polarized light-sensing organic phototransistors are realized by directly assembling a standalone cholesteric liquid-crystal network film in the NIR-sensing organic phototransistor based on a small-bandgap polymer semiconductor. A physical unclonable function device based on the chiral phototransistor arrays can enhance cryptographic characteristics by encoding the polarization direction of the CP light.

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... Supplementary Fig. 20c shows the  $D^*$  of the vertical phototransistors as a function of the incident irradiance. In the accumulated region, the calculated maximal  $D^*$  can reach  $\approx 1.2 \times 10^{13}$  Jones under an incident intensity of  $0.4 \mu\text{W}/\text{cm}^2$ , which is superior to some of the reported narrow bandgap organic-based NIR photodetectors [38][39] [40] [41]. When we extended the NIR light to 740 and 940 nm, the PTCDI-C8 nanowires VPTs have also validated excellent NIR light photoresponse, which are similar to the results obtained at 850 nm NIR light, as shown in Supplementary Figs. ...

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## On the Mechanical and Electrical Properties of the Composite Structure of PVC Membrane and Thin-Film...

July 2021 · Applied Sciences

This paper aims to study the mechanical and electrical properties of the composite structure of PVC film and film cell under biaxial tension. The saddle PVC membrane structure with thin-film battery was obtained by biaxial tensile tests carried out on the composite structure along the fiber direction and at an angle of 45 degrees to the fiber, respectively. The deformation of the film cell and ... [\[Show full abstract\]](#)

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## Influence of pH on the physical properties of CdS thin film and its photosensor application

August 2021 · Applied Physics A

● Ibrahim Mohammed S. M. · ● Ghamdan M. M. Gubari · ● Makrand Sonawane · [...] · ● Ramphal Sharma

Synthesizing thin films on various substrates and serving as electrodes for photosensor is challenging task. In this work, influence of pH on structural and optical properties of cadmium sulfide (CdS) thin film investigated using a chemical bath deposition method on a glass substrate. The fabricated CdS film was characterized by using an X-ray diffraction pattern and field emission scanning ... [\[Show full abstract\]](#)

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## Tuning the optoelectronic properties of n-CdO:Fe/p-Si photodiodes fabricated by facile perfume atomi...

August 2021 · Applied Physics B

M. Rajini · ● Vinoth Subramanian · ● Hari Prasad Kamatam · [...] · ● Saad Alshehri

In this work, a facile spray-assisted perfume atomizer technique was used to prepare CdO and Fe-doped CdO (CdO:Fe) thin films with varying concentrations of Fe (1, 3, and 5 wt%). The deposited films were characterized using different analytical techniques to realize the structural, morphological, optical, electrical, and photosensing properties. From X-ray diffraction (XRD) results, the CdO and ... [\[Show full abstract\]](#)

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## Analysis of Liquid Crystal Tunable Thin-Film Optical Filters Using Signal Flow Graph Technique

July 2021 · International Journal of Optics

Abedalgany Athamneh · [...] · ● Shadi Alboon

In this paper, a liquid crystal tunable thin-film optical bandpass filter is studied and analyzed using the signal flow graph technique. This paper investigates an exact form for calculating the transmission coefficients, reflection coefficients, and the transmission intensity of the filter. The simulation results show the filter performance and the channel shape profile. In addition, the results ... [\[Show full abstract\]](#)

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