Switchable Photonics with Soft-lattice Perovskites

Tech ID: 34455 / UC Case 2024-521-0

ABSTRACT

Researchers at the University of California, Davis have developed a technology that enables rapid, reversible, and opposite-direction optical switching in the mid-infrared range using single crystalline halide perovskite materials activated by either light or heat.

FULL DESCRIPTION

This technology utilizes single crystal cesium lead bromide (CsPbBr3) halide perovskites to enable fast, reversible, and diametrically opposite optical switching of mid-infrared (MIR) transmission. Optical excitation with above-bandgap light reduces transmission via polaron-like lattice distortion, while thermal excitation near 80ºC increases transmission due to lattice expansion and the material's negative thermo-optic coefficient. The switching achieves modulation greater than 10% in under 1 millisecond, making this a promising platform for reconfigurable photonics driven by intrinsic soft lattice properties.

APPLICATIONS

- Mid-infrared photonic devices for sensing and communications.
- Reconfigurable optical filters and modulators.
- Dynamic tunable lenses and beam steering components.
- Infrared imaging and spectroscopy systems.
- High-speed optical switching in integrated photonicst.

FEATURES/BENEFITS

- Reversible switching with opposite polarity via independent optical or thermal control.
- Fast modulation times below 1 millisecond. Significant tunable changes in mid-infrared transmission (>10%).
- Utilizes robust inorganic single crystalline halide perovskite material.
- Low power optical excitation (e.g., 40 mW laser at 532 nm).
- Non-reliant on phase-change materials, reducing degradation.
- Eliminates losses and delay associated with electronic circuit-based light modulation.
- Overcomes limited switching states and high power requirements of phase-change materials.
- Addresses degradation issues of existing phase-change optical switches.
- Expands optical switching capability into the mid-infrared spectrum.
- Offers dynamic and tunable control without compositional changes or mechanical strain.

PATENT STATUS

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OTHER INFORMATION

KEYWORDS

cesium lead bromide, halide perovskite, mid-infrared, optical switching, polaron lattice distortion, reconfigurable photonics, reversible transmission, single crystal, thermal excitation, tunable absorption

CATEGORIZED AS

- **Optics and Photonics**
  - All Optics and Photonics

RELATED CASES

2024-521-0

Patent Pending

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Mechanical Power Generation Through Passive Radiative Cooling
- Thin Film Thermophotovoltaic Cells

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