

Hot-Pressed Perovskite Monolithic System And Method For Fabricating The Same

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ABSTRACT

The present invention pertains to optoelectronic devices, specifically photodetectors using organic-inorganic hybrid perovskites like MAFAPbI₃. Prior art relies on thin-film techniques with ITO/FTO substrates (132) and charge transport layers (138), causing defects, instability to moisture/heat/illumination, inconsistencies, and high costs from processes like spin coating. The solution is a hot-pressed monolithic system (110) via simplified fabrication: synthesize perovskite powder (100) from precursors FAI (112), MAI (114), PbI₂ (116) in 2- methoxyethanol (118), precipitate with toluene (122), dry; compress in die cavity (102) using hydraulic hot press (104) at 90 °C, 50-180 kg/cm² for 1-2 mm tablet (106); deposit electrodes (108) gold/aluminum/platinum) by thermal evaporation (134) with shadow mask (136), sans substrates (132)/layers (138). These yields reduced grain boundaries (128), enhanced crystallinity/stability (higher contact angles (170) vs. thin films (168)), low dark current (174) (1.1×10^{-8} A at 5 V), excellent responsivity (184) (0.19-1.3 A/W), detectivity (186) ($1.2-8.8 \times 10^{11}$ Jones), EQE (188) ($0.32-3.5 \times 10^2\%$) over 390-730 nm, enabling cost-effective scalability for sensing/ imaging.

KEY APPLICATION AREAS

1. Optoelectronic devices (especially photodetectors).
2. Optical sensing systems.
3. Imaging and vision systems.
4. Environmental monitoring devices.
5. Biomedical sensing platforms.
6. Security and surveillance systems.

POTENTIAL USE

1. Broadband light detection (UV to visible range: 390–730 nm).
2. Night vision and surveillance cameras.
3. LIDAR and optical communication systems.
4. Gas/sensor-based environmental monitoring.
5. Wearable and low-cost photonic devices.
6. IoT-based smart sensing systems.
7. Self-powered or low-power photodetectors.