White Light Emission From Single Semiconductor Material Based On Trivalent Mixed Halide Double Perovskites

IITM Technology Available for Licensing

Problem Statement

- Current methods for making white light devices involve complicate manufacturing process using multiple materials.
- Existing materials have problems like **instability and inconsistency**, making it hard to create reliable white light devices.
- Many potential materials cannot be made in large amount, **limiting mass production use.**
- Traditional white light production techniques are not **energy-efficient.**
- Current lighting methods contribute to **pollution** without any **optimal result production**.
- Thus, Developing better white light devices is important for sustainability.
- Hence, the present patent disclosure is needed to **improve energy efficiency and enhance reliability of white light emitting devices** by providing single semiconductor material capable streamline manufacturing of emitting white light.

Technology Category / Market

Categories: Electronics & Circuits | Photonics

Industry: Semiconductor Materials, Solid-State Lighting (SSL) Technology

Application: White Light Emitting Devices

Market: The global **Energy Efficient Lighting** market size was valued at **$53.98 B** in **2023** and is expected to touch **$93.12 B** by **2030** growing at **8.1% CAGR** in the forecasted period.

TRL (Technology Readiness Level)

TRL- 4: Validated in Laboratory.

Research Lab

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Technology

The instant technology disclosure encompasses a **semiconductor material** based on trivalent mixed halide double perovskites for **white light emission & methods** for **thin film deposition and device fabrication.**

- The technology involves a **semiconductor compound** based on trivalent mixed halide double perovskites, **with a specific formula (Cs2AgM11-xM2xCl6)**.
- This compound emits **white light efficiently**, making it **suitable for lighting applications**.
- The compound can be **synthesized using a hydrothermal method**, producing powder, single crystal, or **thin film forms**.
- Thin films of the compound can be **deposited on conducting or semiconducting substrates** using electrophoretic deposition or dip coating methods.
- The compound, when combined with transparent polymers, can be used to **fabricate white light-emitting devices**, like LEDs, through dip coating processes.

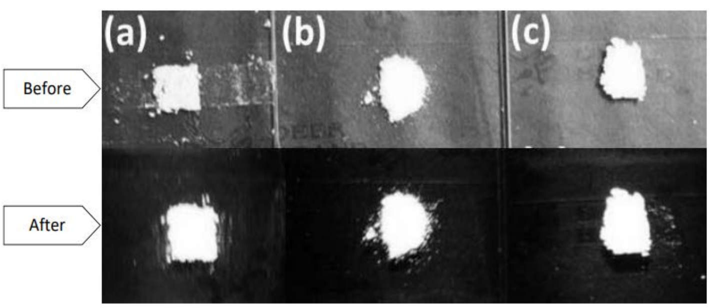
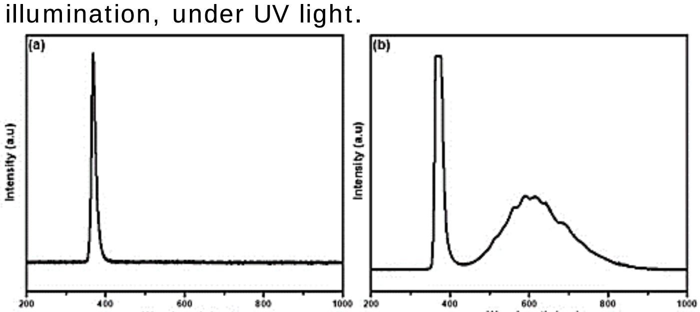


FIG 1 shows photographs of the powder form (a) Cs2AgBi0.20In0.80Cl6, (b) Cs2AgBi0.15In0.85Cl6 (c) Cs2AgBi0.10In0.90Cl6 before and after excitation at a wavelength of 365 nm

FIG 2 shows **(a) spectrum of UV light**, **(b) emission spectrum of the devices** after illumination, under UV light.



Intellectual Property

IITM IDF No.: **1906** | IP No.: **493546 (Granted)**
IITM IDF No.: **2111** | IP No.: **508581 (Granted)**
PCT: **PCT/IN2020/050951**

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Industrial Consultancy & Sponsored Research (IC&SR)

Key Features / Value Proposition

- **Efficiency:** Provides a single semiconductor material for white light emission in simple processes.
- **Energy Savings:** Enhances energy efficiency in lighting applications, reducing electricity consumption.
- **Reliability:** Offers stable and reproducible performance, improving the longevity of lighting devices.
- **Environmental Impact:** Reduces environmental footprint through lower energy consumption.
- **Cost-efficiency:** Reduces manufacturing costs by streamlining processes and utilizing fewer materials, resulting in more affordable white light emitting devices.
- **Versatility:** Applicable in residential, commercial, industrial, automotive, healthcare, displays, etc.

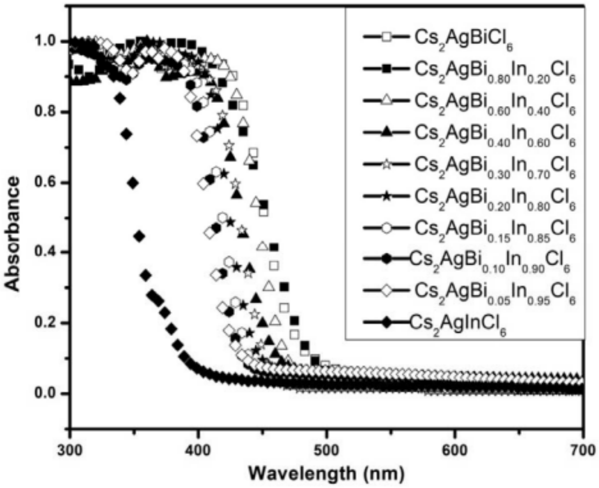
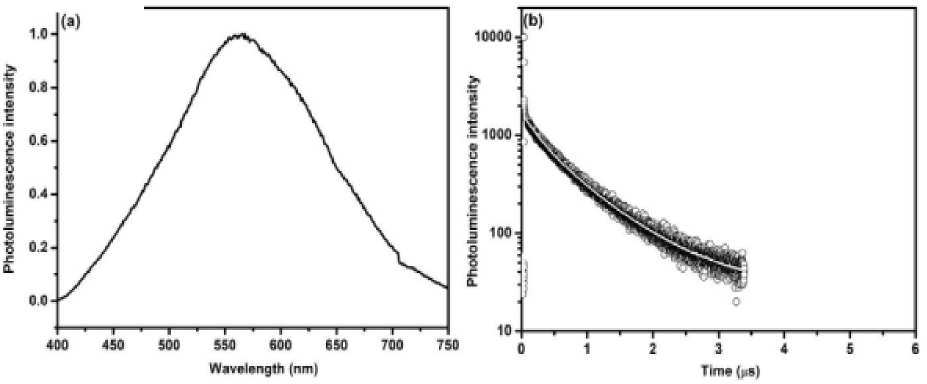


FIG 3 shows the UV visible spectrum of Cs2AgBi1-xInxCl6, wherein x value is in the range of 0 to 1

FIG 4 shows
a) steady state photoluminescence
b) time-resolved correlated photoluminescence decay of Cs2AgBi0.10In0.90Cl6 thin film



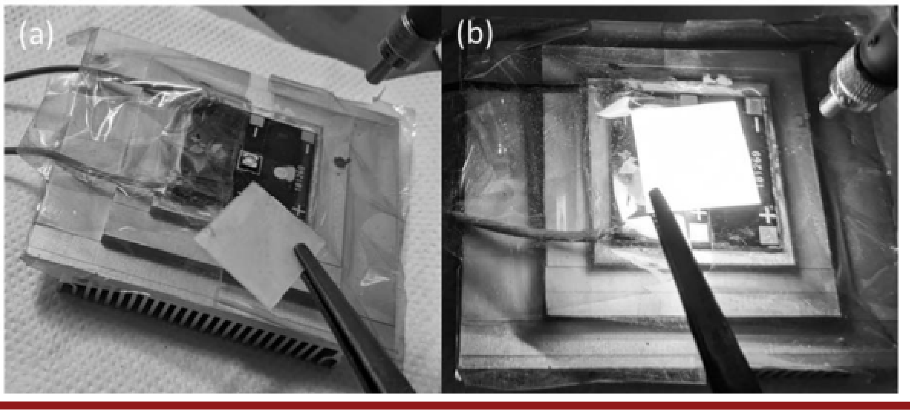


FIG 5 shows the photograph of the compounds Cs2AgBi0.10In0.90Cl6 with PMMA
(a) before excitation
(b) after excitation at a UV light;

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