Enhancing Photoluminescence Quantum Yield for High Performance Optoelectrics

Tech ID: 25573 / UC Case 2016-079-0

**Patent Status**

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<th>Country</th>
<th>Type</th>
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<td>United States Of America</td>
<td>Issued Patent</td>
<td>9,852,927</td>
<td>12/26/2017</td>
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**Brief Description**

Surface defects dominate the behavior of minority carriers in semiconductors and optoelectronic devices. Photoluminescence quantum yield (QY), which dictates efficiency of optoelectrics such as LEDs, lasers, and solar cells, is extremely low in materials with a large number of surface defects. Researchers at UC Berkeley and Lawrence Berkeley National Laboratory have developed a bis(trifluoromethane) sulfonamide (TFSI) solution for passivation/repair of surface defects in 2D transition metal dichalcogenide (TMDC). This air-stable solution-based chemical treatment provides unmatched photoluminescence QY enhancement to values near 100% without changing the surface morphology. The treatment eliminates defect-mediated non-radiative recombination, which eliminates the low performance limit of TMDC and enhances its minority carrier lifetime. This novel development can address surface passivation in numerous semiconductors which will lead to highly efficient light emitting diodes, lasers and solar cells based on 2D materials.

**Suggested Uses**

- LEDs
- Lasers
- Solar Cells
- Semiconductor emitters and detectors

**Advantages**

- Quantum yield enhancement to near-unit values
- Surface recombination velocity reduction
- Improved Voc in solar cells
- PL peak intensity increase

**Related Materials**

**Inventors**

- Javey, Ali

**Other Information**

**Keywords**

- 2D, optoelectronic, semiconductor, passivation, photoluminescence quantum yield, surface defect, QY, metal dichalcogenide, TMDC

**Categorized As**

- Energy
  - Solar
- Materials & Chemicals
- Chemicals
- Semiconductors
- Processing and Production

**Related Cases**

2016-079-0

**Additional Technologies by These Inventors**

- A Thin Film VIs Semiconductor Growth Process
- Chemical-Sensitive Field-Effect Transistor