Layered monochalcogenides have been predicted as efficient materials for photoelectrochemical (PEC) applications. In this work, single-/few-/multi-layer flakes of germanium selenide (GeSe) have been produced by liquid-phase exfoliation of GeSe crystals to develop water splitting system and self-powered PEC-type photodetectors. The devices show responsivities up to 0.32 $\text{A W}^{-1}$ at -0.5 V vs. RHE under 455 nm excitation wavelength in acidic electrolyte (0.5 M H$_2$SO$_4$), in which they also stably operate.

### Introduction

Layered GeSe

Depending on pH and thickness, GeSe nanoflakes can act as photocatalysts for hydrogen and oxygen evolution reaction (HER and OER).

### Liquid Phase Exfoliation Process

**Advantages:**
- Scalable production of GeSe nanoflakes-based inks
- High-processability through printing techniques

**Equipment:**
- Sonic bath
- Centrifuge

**Solvent:**
- 2-propanol (IPA)

### Morphological Characterization

**GeSe-based Electrode Fabrication and Experimental Setup**

- SPRAY-COATING DEPOSITION
  - Industrially compatible
  - Scalable
  - Flexible electrodes

### Photoelectrochemical Characterization of GeSe PEC-type Photodetectors

The obtained performances are superior to those of several self-powered and low-voltage solution-processed photodetectors, approaching the ones of self-powered commercial UV–Vis photodetectors. Our results open the way towards the use of 2D GeSe in novel PEC systems.

### Conclusion

The obtained performances are superior to those of several self-powered and low-voltage solution-processed photodetectors, approaching the ones of self-powered commercial UV–Vis photodetectors. Our results open the way towards the use of 2D GeSe in novel PEC systems.