Band alignment analysis of 2D SnS with Anatase (101), Rutile (110), and ZnO (100) by x-ray photoelectron spectroscopy.

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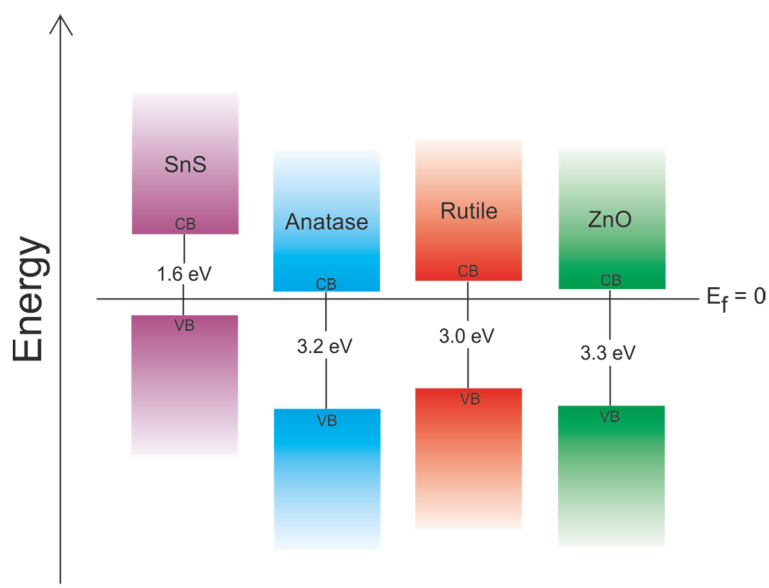
Dye, quantum dot and perovskite sensitised metal oxides are a subject of intensive research. An alternative approach to sensitising surfaces is to use small band gap 2-D materials, such as chalcogenides where the band gap can be tuned by varying the number of layers [1]. In order for such devices to operate the relative positions of valence and conduction bands of the sensitiser and n-type material is important.

Here we report on the measurement of band alignment of 2-D SnS deposited on anatase (101) surface by x-ray photoelectron spectroscopy (XPS). The 2-D SnS was obtained by liquid-phase exfoliation and deposited directly onto an anatase (101) single crystal surface, which had been cleaned under ultra-high vacuum conditions. To determine the alignment the valence band offset for the heterojunction n-TiO2/p-SnS was measured using soft XPS which gave an overlap of 0.55 eV. Literature values of the band gaps of 2-D SnS (1.6 eV) [1] and anatase TiO2 (3.2 eV) [2] were used to determine the conduction band position. Analysis shows that the interface between p-SnS and single crystal anatase phase n-TiO2 has a type II offset. Under the same conditions Rutile (110) and ZnO (100), with bandgaps of 3.0 eV [3] and 3.3 eV [4]respectively, also demonstrated a type II offset interface with 2-D SnS. Rutile (110) and ZnO (100) showed larger overlaps with 2-D SnS of 0.9 eV and 0.7 eV respectively.



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