

X-ray photon electron spectroscopy as structural and chemical surface probe on 2D chalcogenides layers

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Layered two-dimensional (2D) materials have received great attention due to their unique physical and chemical properties when downsized to single or few layers [1, 2]. Among various layered materials, post-transition metal chalcogenides (PTMCs) have been getting increasing interest; these materials are composed of ranging from main group IIIA to group VA (Ga, In, Ge, Sn, Sb and Bi) and group VI chalcogen atoms (sulfur (S), selenium (Se) and tellurium (Te)).

Recently, several types of PTMCs, as emerging family of important semiconducting materials, have received increasing attention due to their highly anisotropic structure, unique electronic structure, intriguing electrical and optoelectronic properties, which have been applied in electrochemistry [3], photo-electrochemistry [4], electronics [5], optoelectronics [5], and gas sensing [6].

In this study, XPS analyses have been performed on antimony sulfide, Sb_2S_3 , and gallium chalcogenides GaX ($X=S, Se, Te$). Specifically, the amorphous-to-crystalline transformations of the phase change Sb_2S_3 by thermal annealing and green laser irradiation have been investigated by XPS analysis, corroborating the morphological and optical characterizations [7].

Concerning the exfoliated gallium chalcogenides, an ambient aging study has been investigated; the XPS data have revealed the dependence of the air stability over the time on the VI group element of the periodic table in GaX : the oxidation rate of the chalcogenide surface increases passing from sulfur to tellurium.

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