Type of presentation: Oral

IT-5-O-1665 Atom-by-atom chemical imaging of topological insulator nanostructures by ChemiSTEM

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Topological insulators (TIs) have attracted ever-increasing attention due to their exotic physical phenomena, however, the overwhelming majority of reported work was focused on the physical properties [1,2]. In contrast, limited effort has been made to gain an accurate picture for their chemical compositions at atomic level, although such information is of critical importance to comprehend their demonstrated properties. Here by employing a state-of-the-art atomic-mapping technology (ChemiSTEM), we present a direct atom-by-atom chemical identification of nanostructures and defects in TIs [3]. We first identify and explain the layer-chemistry evolution of $Bi_2Te_{3-x}Se_x$ TIs (Fig. 1). Significantly, we reveal a long neglected but crucially important defect which is universally present in Bi_2Te_3 films, the seven-layer Bi_3Te_4 nano-lamella (Fig. 2). This nano-lamella may explain inconsistencies in measured conduction type as well as open up a new route to manipulate the bulk carrier concentration. This work may pave the way to thoroughly understand and tailor the nature of the bulk, and to secure controllable bulk states for their future dissipationless devices.

References

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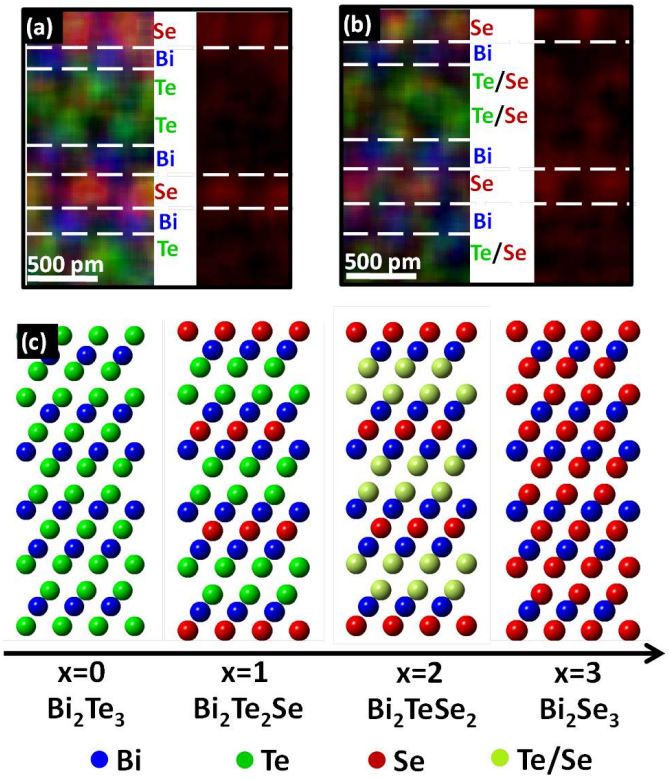

Fig. 1: Layer-chemistry evolution of $Bi_2Te_{3-x}Se_x$ (x=0, 1, 2, 3).

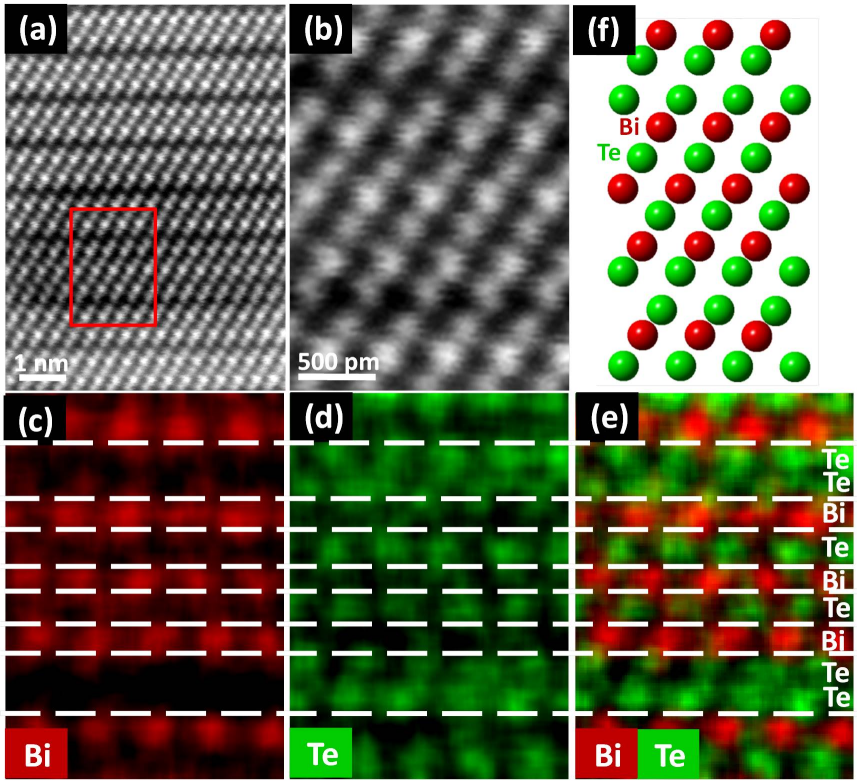

Fig. 2: Structural and chemical identifications of the 7-layer lamellae in Bi_2Te_3.