Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Atomic layer deposition of crystalline Bi_2O_3 thin films and their conversion into Bi_2S_3 by thermal vapor sulfurization

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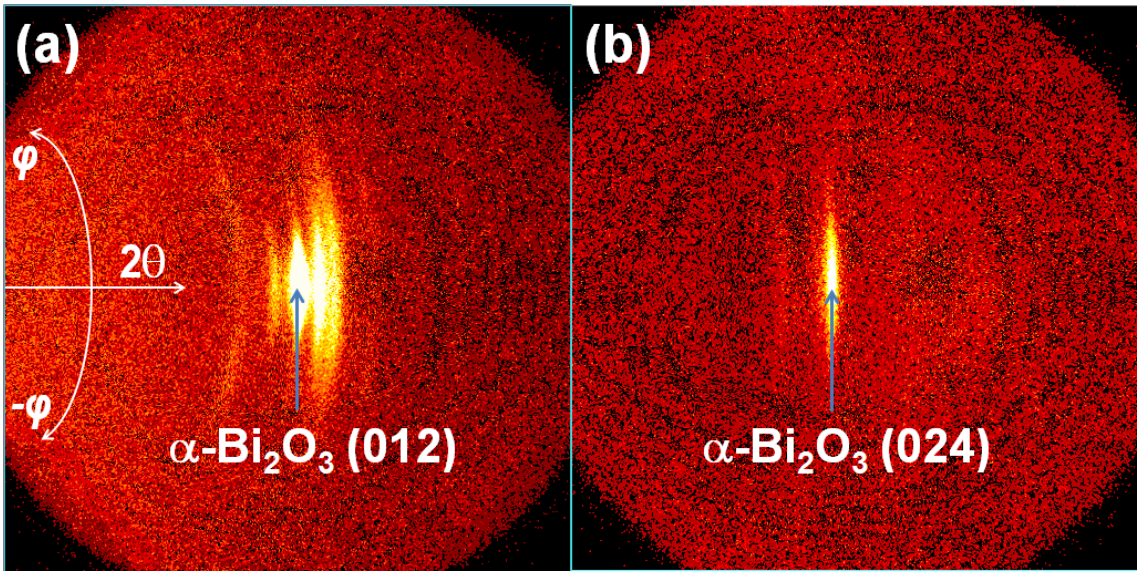

Figure S1: XRD area imaging of the diffraction intensity distributions in φ-2θ frames (a) targeting the α-Bi_2O_3 (012) diffractions and (b) targeting at the α-Bi_2O_3 (024) diffractions.

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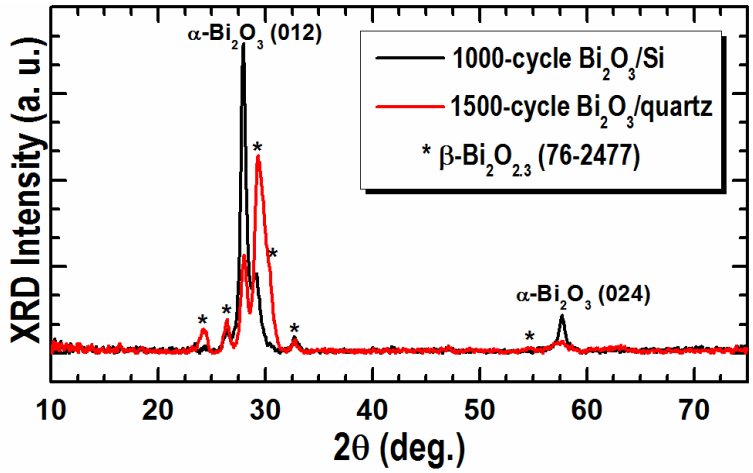

Figure S2: XRD patterns collected from the B_2O_3 thin film samples grown by ALD on Si and quartz substrates.

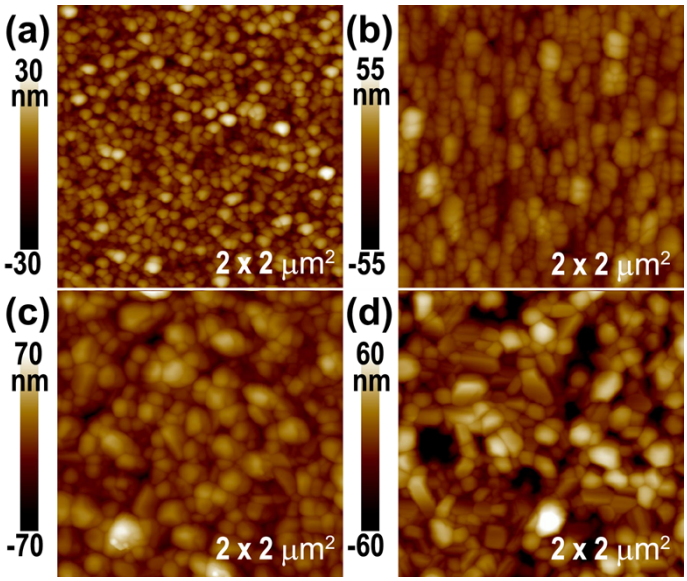

Figure S3: AFM images recorded from the sulfurized Bi_2S_3 samples, i.e., the Bi_2O_3 thin film samples after sulfurization, on quartz substrates: (a) 500 cycles sulfurized at 500 °C, (b) 1000 cycles sulfurized at 500 °C, (c) 1500 cycles sulfurized at 500 °C, and (d) 1500 cycles sulfurized at 600 °C.

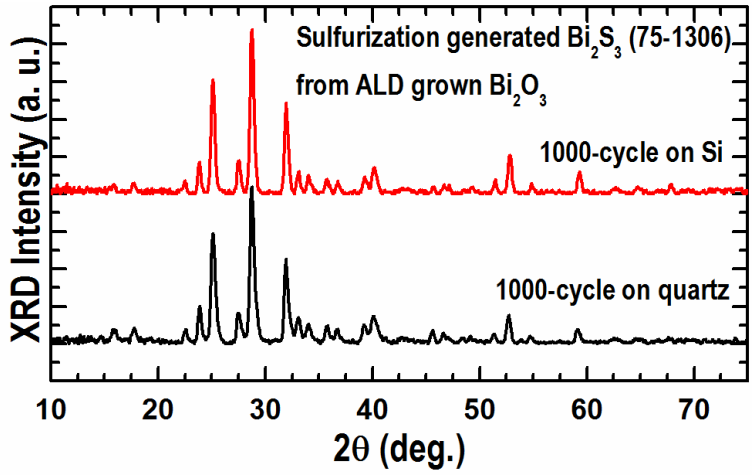

Figure S4: XRD patterns collected from the sulfurized (at 500 °C) B_2S_3 thin films with the initial Bi_2O_3 grown by ALD on Si and quartz substrates.

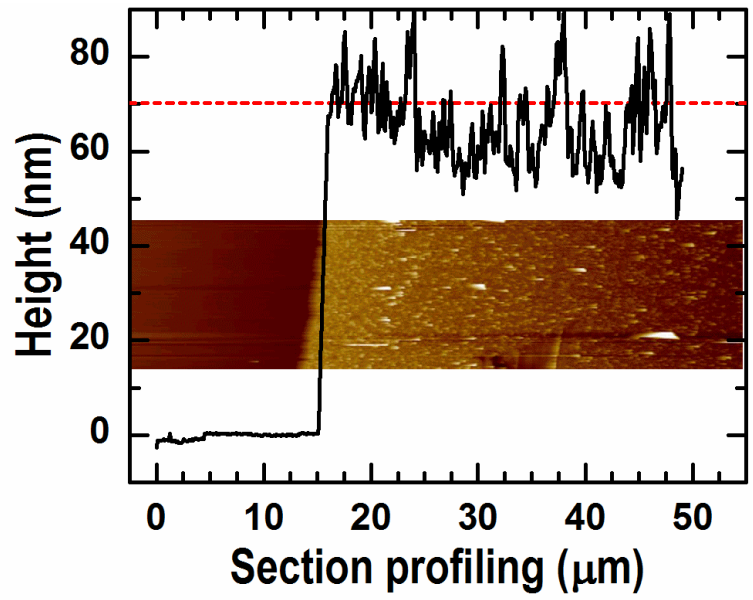

Figure S5: Thickness measurement of the sulfurized Bi_2S_3 thin film by AFM from the edge of an intentionally starched area.

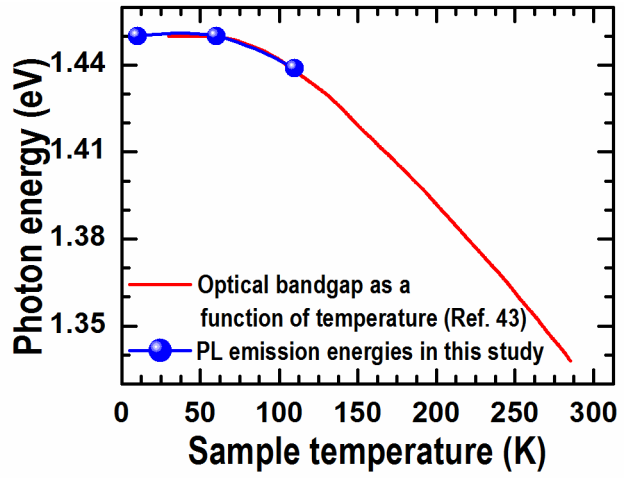

Figure S6: Comparisons of the measured PL emission energies in this study with those of optical bandgap energies reproduced with permission from Ref. 43.

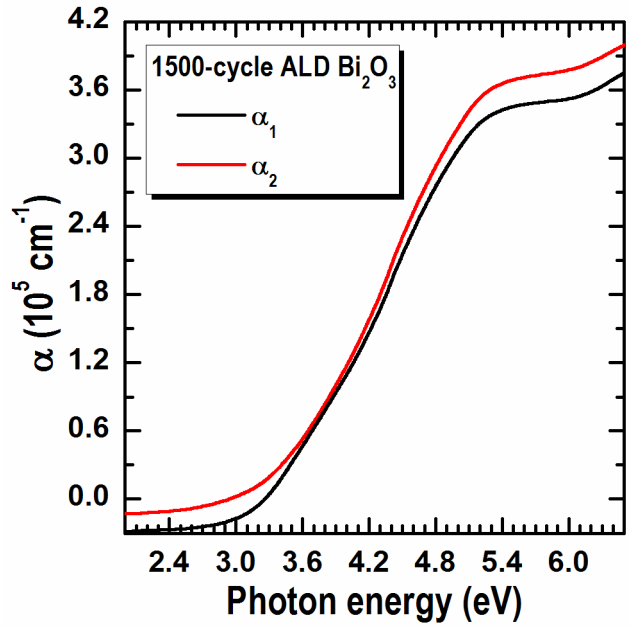

Figure S7: Absorption coefficient spectra of 1500-cycle ALD grown Bi_2O_3 obtained via $\alpha_1 = \ln[(1-R)/T]/d$ and $\alpha_2 = \ln\left[\frac{(1-R)^2 + \sqrt{(1-R)^4 + 4R^2T^2}}{2T}\right]/d$ by measuring the reflectance R and transmittance T.