

Supplementary Information

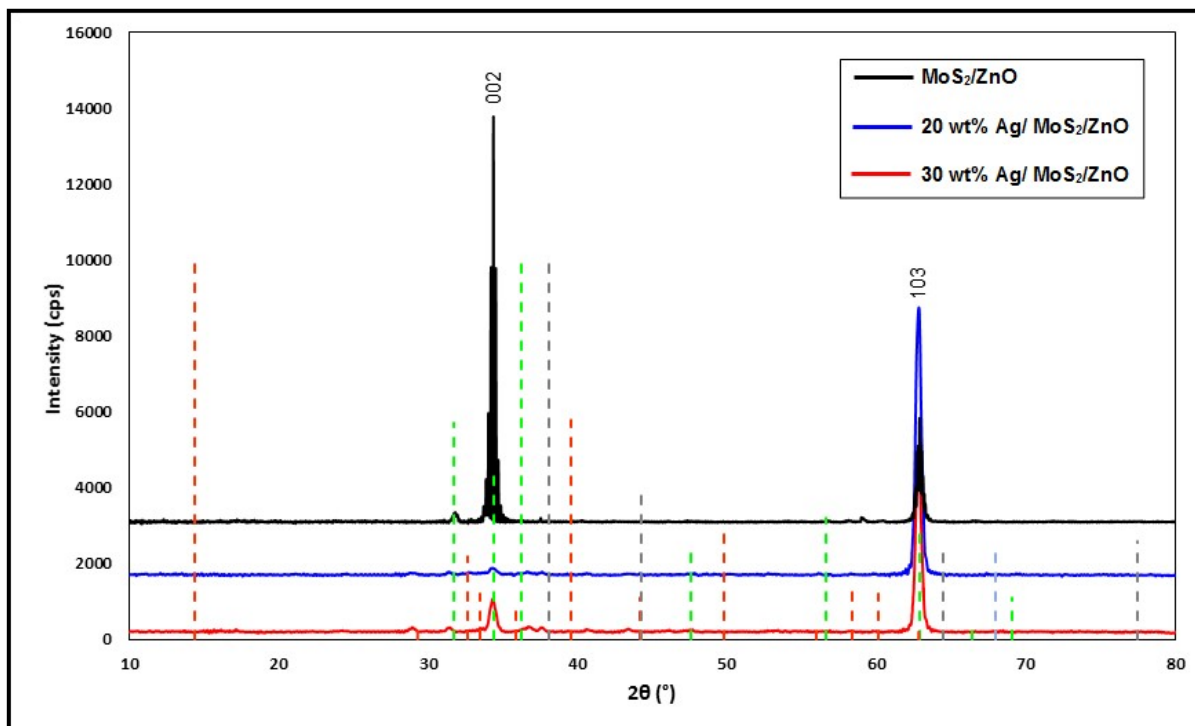


Fig. S1: XRD pattern for sample MoS₂/ZnO, 20 wt% Ag/ MoS₂/ZnO and 30 wt% Ag/ MoS₂/ZnO. The orange colour dashed line represents standard pattern for MoS₂, green colour dashed line represents ZnO standard pattern and grey colour dashed line represents Ag standard pattern.

From the XRD pattern in Fig. S1, it is observed that the highest peaks (at 36°) are well matched with ZnO standard pattern (JCPDS 361451), whereas the MoS₂ and Ag peaks are hardly observed due to low concentration. Moreover, the as-synthesized MoS₂ in this study are partially crystalline in nature¹ and thus difficult to be detected, while the reflected signal of highly crystalline ZnO nanorods that presence in huge quantity has also suppresses the signal of both Ag and MoS₂. In order to resolve this shortcoming, the presence of both Ag nanoparticles and MoS₂ nanoflakes are probed by XPS analysis (Fig. 3 and 4).

The most dominant peak located at 36° are corresponding to crystal plane of (002). The high intensity of peak (002) indicates that ZnO nanorods grow along (0001) c-axis orientation. Meanwhile, the presence of (103) plane at 63° can be associated to AZO substrate layer, which is generally ascribed to the lateral orientation plane of ZnO that can be acquired by sputtering deposition². Additionally, for sample 20 wt% Ag/ MoS₂/ZnO, the intensity of both these peaks are decrease due to the coverage of the Ag/MoS₂ on the surface of ZnO nanorods that has introduced a shielding effect. Both of these peaks show tendency of higher intensity for sample 30 wt% Ag/ MoS₂/ZnO due to serious agglomeration that has taken place and thus enable more ZnO surface to get exposed to X-ray, which ultimately reduce the shielding effect.

References:

1. S. Heo, Y. Ishiguro, R. Hayakawa, T. Chikyow and Y. Wakayama, *APL Materials*, 2016, **4**, 030901.
2. I. Cosme, S. Vázquez-y-Parraguirre, O. Malik, S. Mansurova, N. Carlos, A. Tavira-Fuentes, G. Ramirez and Y. Kudriavtsev, *Surface and Coatings Technology*, 2019, **372**, 442-450.