Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information for

Synergistic effect of polymer encapsulated silver nanoparticles doped WS_2 sheets for plasmon enhanced 2D/3D heterojunction photodetectors

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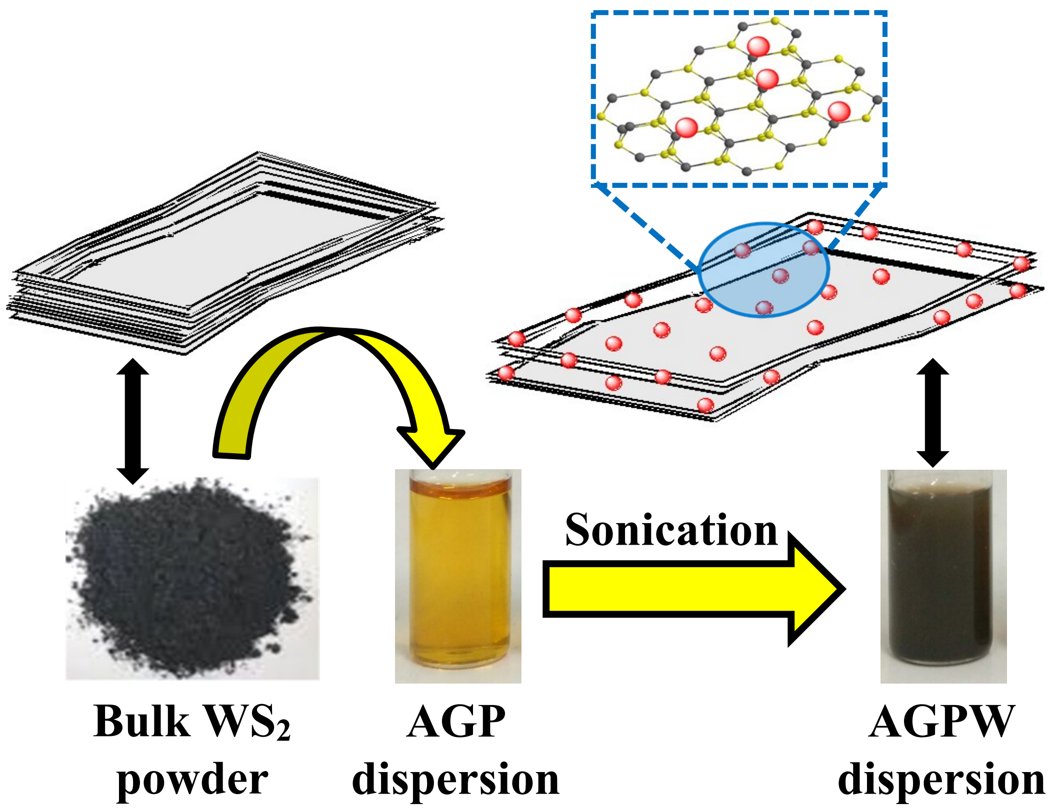

Fig. S1 Schematic illustration of intercalation process of bulk WS_2 using PVP encapsulated Ag^o nanoparticles (AGP) to obtain few layers WS_2-AGP (AGPW) nanocomposite.

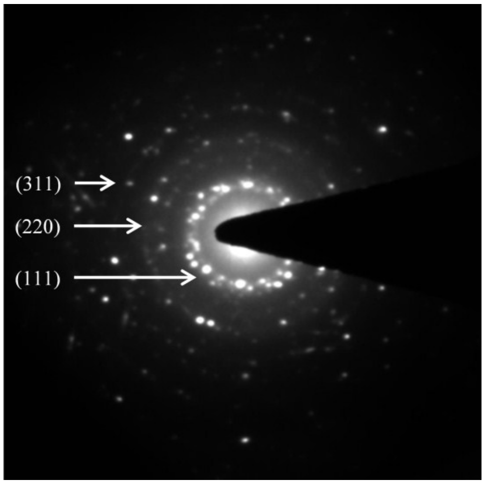

Fig. S2 Selected area electron diffraction pattern of AGPW showing the presence of polycrystalline Ag°.

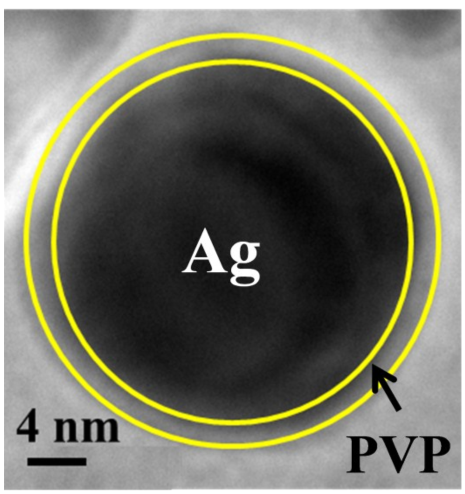

Fig. S3 High resolution TEM image showing the volume fraction of the PVP encapsulation as ~20 % compared to ~ 80 % for Ag (PVP thickness ~ 2 nm, which is thin enough for tunneling of charge carriers for biased devices).

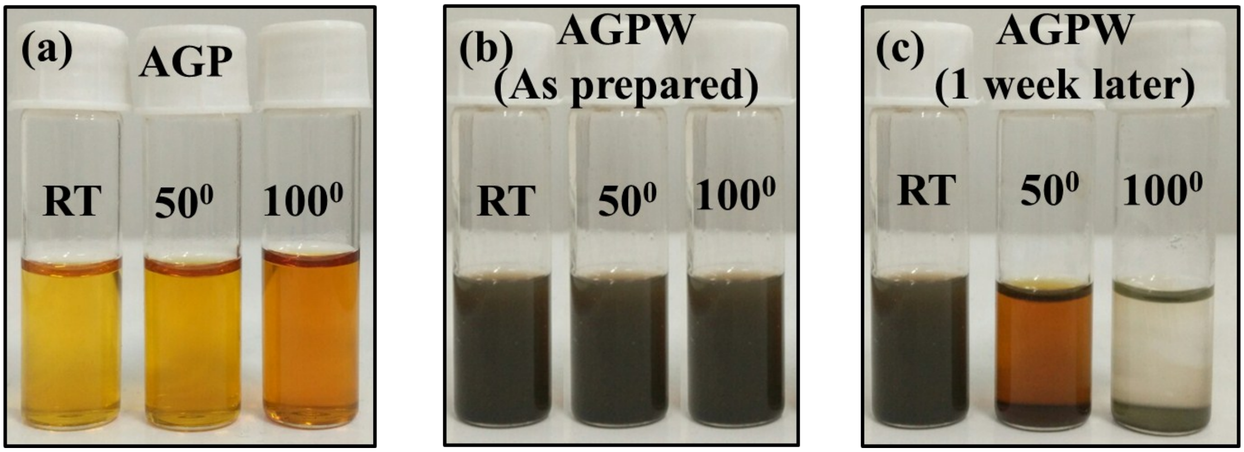

Fig. S4 (a), (b) and (c) Optical photographs of AGP (synthesized at room temperature, 50^0 C and 100^0 C), freshly prepared AGPW and AGPW dispersions after one week of the synthesis, respectively.

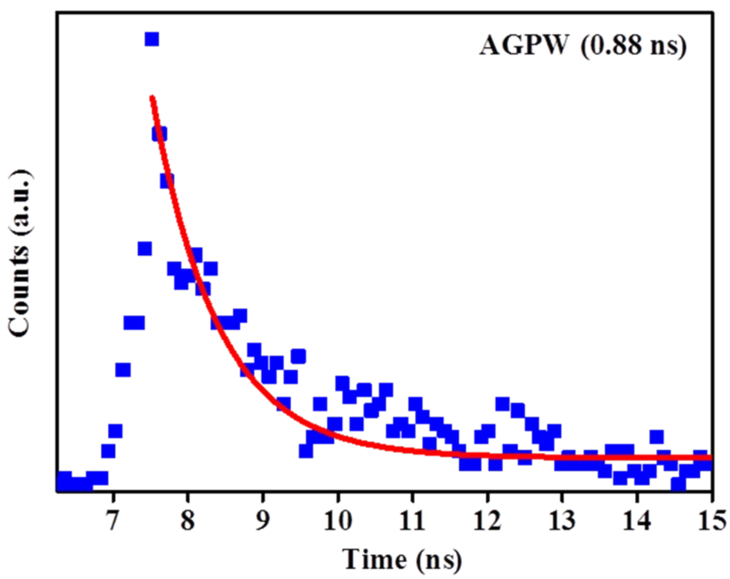

Fig. S5 Typical time resolved PL spectrum of AGP (~ 4-6 nm, prepared at room temperature) intercalated WS_2 (AGPW) layer.

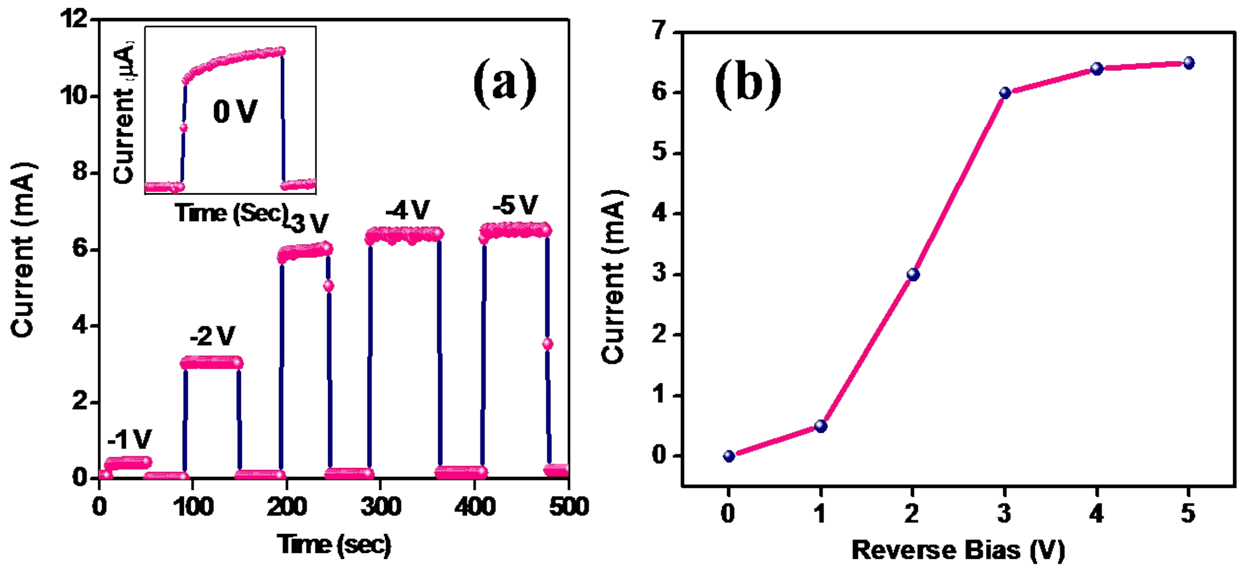

Fig. S6 (a) Optical switching response under different reverse bias condition. Inset shows an enlarged view of the switching characteristics for zero bias. (b) Variation in photocurrent under the increasing reverse bias, which saturates at -5 V.

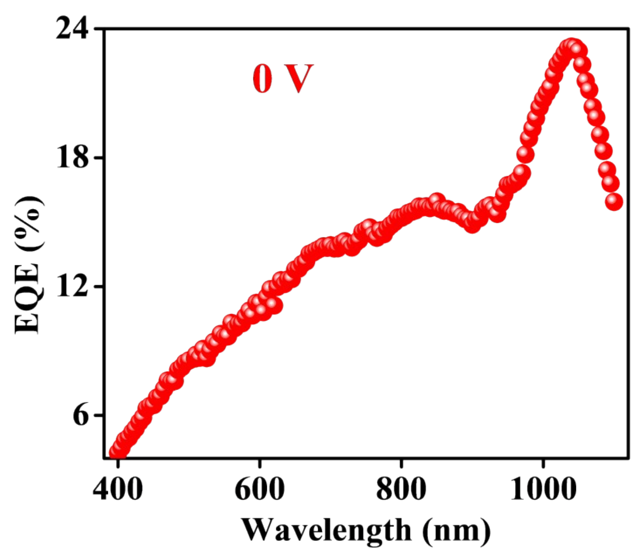

Fig. S7 External quantum efficiency (EQE) of plasmonic n-AGPW/p-Si heterojunction device at 0 V.

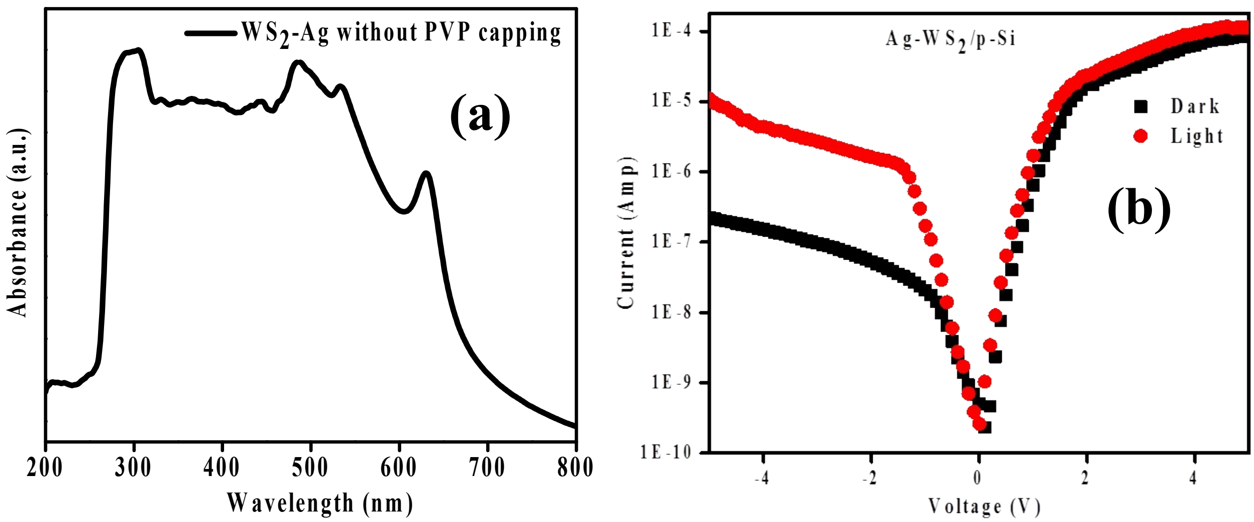

Fig. S8 (a) UV-Visible spectrum of WS_2-Ag nanoparticles without PVP capping, dominated by the Ag_2S absorption peaks. (b) Typical current-voltage (I-V) characteristics of Ag-WS_2 without PVP capping/p-Si heterojunction device.