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Enhanced Photoluminescence of Monolayer WS2 on Ag Films and Nanowire−WS2−Film Hybrids[1] FEI CHENG, ALEX D JOHNSON, PING-HSIANG SU, YUTSUNG TSAI, CHIH-KANG SHIH, Univ of Texas, Austin, CHIH-KANG SHIH TEAM — Monolayer transition metal dichalcogenides is a promising material for integrated optoelectronic devices. Nevertheless, their small absorption length and moderate photoluminescence (PL) need to be compensated for effective utilization. We demonstrate here an enhanced light-matter interaction in monolayer WS_2 by utilizing hybrid plasmonic nanostructures. Since a gain media in close proximity to metal may quench PL, we investigate systematically how the PL of WS_2, as a function of temperature, depends on the spacer thickness of hybrids. Unlike typical gain media-plasmonic composites where an optimal thickness of spacer layer is ˜5 nm or larger, we find that the maximum enhancement occurs at ˜1 nm and the PL is increased by more than an order of magnitude on Ag films due to exciton-coupled surface plasmon polaritons (SPPs). We also explore a composite, Ag nanowire$-WS_2-$Ag film, and observe not only additional enhancement of PL (by a factor of 3) by SPPs reflected from wire end but also improvement of epitaxial film over thermal one (by factor of 2), which is attributed to suppressed propagation loss of SPPs on epitaxial films.

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