Tailoring B-exciton emission in few-layers MoS_2:$AgPO_3$ nanoheterojunctions

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Tailoring the photoluminescence (PL) in two dimensional (2D) transition metal dichalcogenide (TMDs) using external factors is one of remarkable interest for its use in emerging valleytronics, nanophotonic and optoelectronic applications.[1,2] Significant effort have been devoted to enhance or manipulate the excitonic emission in a monolayer MoS_2. However, it has limited to the nanoscale fundamental studies for nanoelectronics and photonics applications. Here, we will talk about a novel van der Waal nano-hybrid/heterojunctions system fabricated with a non-lithographic process to manipulate the PL emission, which is composed of a few layer MoS_2 integrated into a transparent semiconducting silver metaphosphate glass matrix. Successful isolation and formation of heterojunction revealed the preservation of phase integrity and the crystallinity. The heterojunctions demonstrated exotic intrinsic A- and B- excitonic peak emission. More interestingly we are able to tailor a dominant B- excitonic emission over A exitonic emission. A significant 6-fold enhancement in PL spectrum (van der Waals hetrojunctions) over a control sample was recorded (Figure 1).[3] Furthermore, ternary silver-rich and binary sodium meta phosphate glass heterojunction were demonstrated to investigate the origin of the excitonic enhancement. Exciton plasmon coupling was under taken to demonstrate the enhancement in B-excitonic emission of the van der Waals nanoheterojunctions. Finally, ultrastfast time-resolved spectroscopy interpreted the plasmon-enhanced electron transfer that takes place in Ag nanoparticles-MoS_2 nanoheterojunctions is behind the enhancement of the excitonic emission. No doubt, the efficient coupling of exciton-plasmon and tunability of B- excitonic emission pave great attention in emerging valleytronic and light emitting devices working with B excitons.

References

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Figures

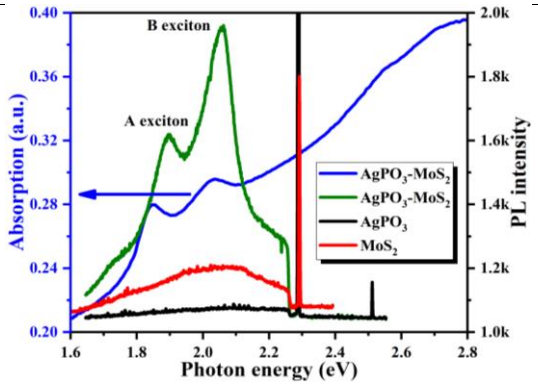

Figure 1: Optical absorption and photon energy dependent photoluminescence of controlled, MoS2 nano heterojunctions and bare MoS2 sample.