Spatially Resolved Optoelectronics in Lead Sulfide Nanowires

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It is important to understand charge transport and recombination in nanostructures to optimize their properties for a variety of optoelectronic applications including solar cells. Spatially resolved photocurrent measurements using scanning photocurrent microscopy (SPCM) can provide valuable information on internal electric field and charge diffusion length in nanostructures. In this talk, I will focus on our recent SPCM results for lead sulfide (PbS) nanowires (NWs).

Using a simple, controlled doping method, we have achieved n-type, intrinsic, and p-type PbS NWs grown by chemical vapor deposition. A wide range of carrier concentrations is realized by adjusting the ratio between the Pb and S precursors. The field effect electron mobility of n-type PbS NWs is up to 660 cm^2/Vs at room temperature. Interestingly, we have observed a strong dependence of minority carrier diffusion length on gate voltage, which can be understood by considering a carrier concentration dependent recombination lifetime. We have also observed the reversal of the photocurrent direction at high excitation intensity.