Defect Induced Mobility Modulation in MoS_2 FET

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Abstract

Recently semiconductor industry is facing the limitation of scaling and it is urgent to find a new type of material to replace Si. Layered materials provide a solution to this problem since the thickness of a monolayer of layered materials can be reduced to only few atoms. Thus, the electronic devices made by layered materials can overcome the current scaling problem and achieve several dreamed properties such as light, thin and even transparent. MoS_2, a member of transition metal dichalcogenides (TMDs) can be used to fabricate field effect transistors (FETs) though many ways. Our experiment is trying to visualize how the density of defect in MoS_2 FET can modulate the mobility of FET made by few-layer MoS_2. By using scanning tunneling microscopy/spectroscopy (STM/STS) and four probe measurements, we have found that MoS_2 FET with high mobility exhibits twice number of void defects (2.6×10^{11} cm^{-2}) than the low-mobility one and its band structure become heavily n-doped. Further examination of more FETs is required for making sure the relationship between the defect density and carrier mobility..