Annealing and ionic liquid gating on suspended molybdenum disulfide devices

FENGLIN WANG, PETR STEPANOV, MASON GRAY, MIKHAIL ITKIS, ROBERT HADDON, CHUN NING LAU, University of California Riverside — We fabricate suspended molybdenum disulfide (MoS$_2$) field effect transistors (FET) devices and develop an effective gas annealing technique that significantly improves device quality and increases conductance by 3-4 orders of magnitude. Temperature dependence measurements reveal two transport mechanisms: electron-phonon scattering at high temperatures and thermal activation over a gate-tunable barrier height at low temperatures. Our results suggest that transport in these devices is not limited by the substrates. Moreover, this suspended MoS$_2$ device structure provides double surface access for ionic liquid gating. We are able to extract the dielectric constant of the ionic liquid, and the latest experimental results will be presented.