NANOHOUR

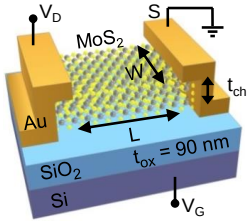
Wednesday, February 12, 2014 3:00 pm
Beckman Institute - Room 3269

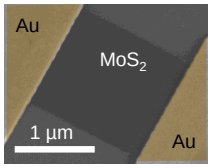
Velocity Saturation and Negative Differential Conductance in Two-Dimensional MoS_2 Transistors

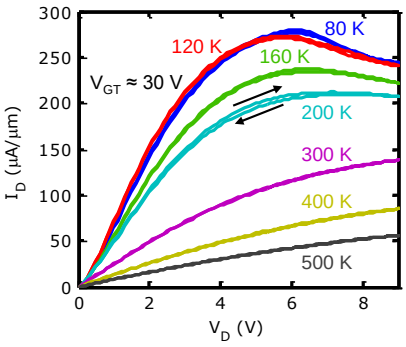
Vincent Dorgan, Electrical and Computer Engineering

Graduate Student with Professor Eric Pop

We uncover velocity saturation and negative differential conductance (NDC) in MoS2 transistors through measurements over a wide range of temperatures (T = 80-500 K) and electric fields (F = 0-6 V/μm). High-field NDC is seen at F > 2 V/μm and ambient T ≤ 200 K, but at higher temperatures the drift velocity shows usual saturation behavior (vsat ≈ 2×106 cm/s at 300 K). Comparisons with electro-thermal and Boltzmann transport simulations reveal this behavior is caused by a combination of self-heating and transport through multiple conduction bands. Such results have not been previously observed in two-dimensional semiconductors and provide key insights into the effect of their complex band structure on practical device operation.



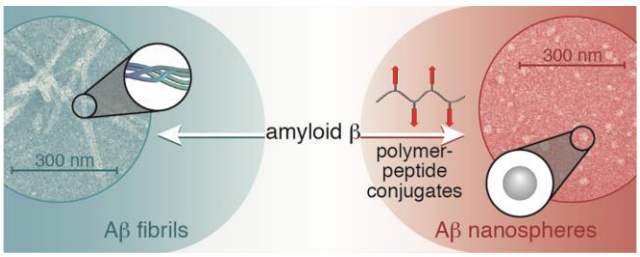




Multivalent Macromolecules Redirect Nucleation-dependent Fibrillar Assembly into Nanospheres

Yang Song, Chemistry

Graduate Student with Professor Jeff Moore



Manipulating the size and shape of non-covalent multivalent assemblies is an ongoing challenge in the field of supramolecular polymers. Following a mechanistic approach, we reasoned that nucleation-elongation kinetics presents unique opportunities for controlled growth since the final outcome is likely to depend on the structure and dynamics of critical-nucleus formation. Taking fibrillar assembly of amyloid β (Aβ) peptide as the model system of nucleation-dependent supramolecular polymerization, here we report multivalent polymer-peptide conjugates (mPPCs) that redirect fibrillar assembly of Aβ to form uniform nanospheres. The mPPCs were rationally designed to target Aβ intermediates formed prior to critical nucleation. Atomic force microscopy and transmission electron microscopy studies show that in the presence of mPPCs, Aβ self-assembles into zero-dimensional nanospheres with diameters approximately in 5-30 nm, while Aβ alone self-assembles into one dimensional fibrils in micrometer. Thioflavin T kinetics fluorescence assays demonstrate that mPPCs suppress Aβ fibrillogenesis. The mPPCs may thus represent a prototypical molecular design of multivalent macromolecules able to control the final shape of supramolecular polymers assembled via a nucleation-dependent mechanism.

Coffee and cookies will be served

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