

MSE 4241

Homework #3 (10% of grade)

Due March 5 (NEXT Thursday) at start of class.

1. Describe 3 challenges for nanoscale transistors.
2. You have built an ideal single electron transistor. You find that it behaves ideally if kept in the dark, but when light shines on it the current response is not as you predict.
 - a. You check the optical absorption spectrum and notice that light with a wavelength of 800 nm is strongly absorbed. Given this, do you expect absorption with longer wavelengths? Shorter wavelengths? Is there any pattern to the absorption, and if so what (i.e. is it continuous, only for a single wavelength, or for a series of well defined wavelengths)? Explain your answers.
 - b. Propose how the drain-source current (I_{ds}) varies with drain-source voltage (V_{ds}) for a dark measurement, for a measurement with 1200 nm illumination, and for a measurement with 800 nm illumination. You may assume that the 1200 nm light is not absorbed at all.
3. In 1 page total:
 - a. Describe how a Self Assembled Monolayer works.
 - b. Describe how to perform micro-contact-printing.
4. In 1 page total: Describe how the following can dictate the phase morphology of block copolymers:
 - a. Copolymer proportions
 - b. Film thickness
 - c. Surface energy
 - d. Topographic constraints