Future Projects

DNA Origami

DNA can be folded into various shapes using smaller DNA strands called staples. DNA origami has potential uses in nano-scale construction and can be used in conjunction with quantum dots to create new materials.

Liquid Crystals

Some molecules exist as a liquid, but maintain a common orientation with its neighbors like a crystal. Many monitors and televisions use these liquid crystals to control light passing through a pixel. Liquid Crystals have a variety of uses and properties useful for undergraduate research.

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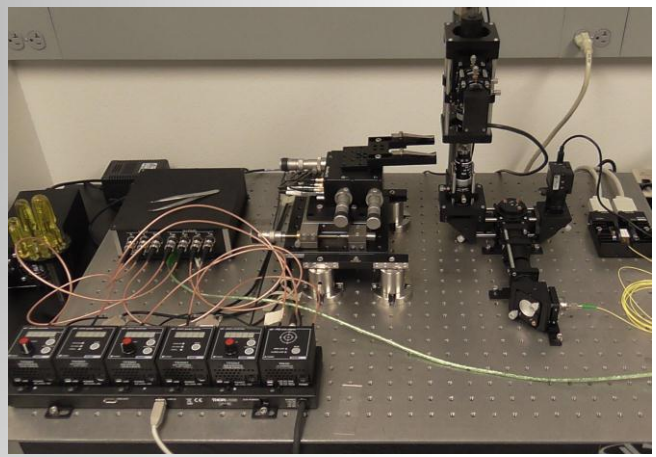
E.N.S.E.R.

Energy and **N**ano-**S**cience for **E**ducation and **R**esearch



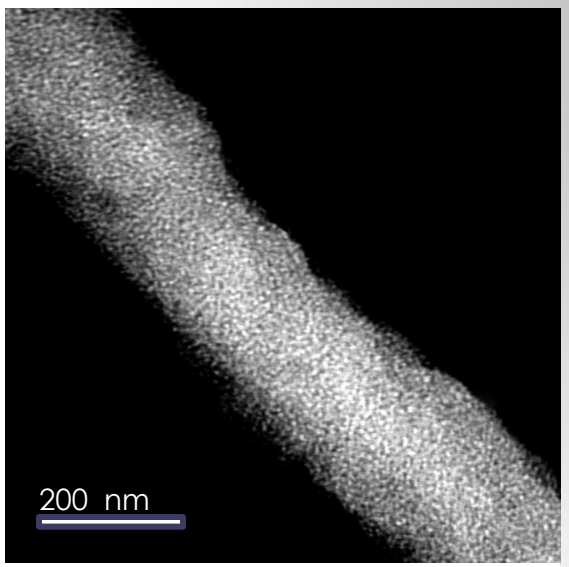
UNC Physics and Astronomy

About E.N.S.E.R.

E.N.S.E.R. is dedicated towards providing research opportunities for students in the natural and health sciences. The lab is focused towards nano-scale material science and renewable energy. E.N.S.E.R. is open towards UNC students who show an interest in these fields. Here are a few examples of current or planned research topics.

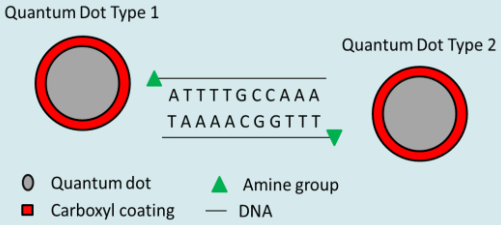
Quantum Dots (QDs)

These are tiny crystals that are just a few nanometers across. These crystals have unique properties when exposed to light. Certain properties of QDs depend on their size. The control over these properties make QDs of interest for use in many scientific and industrial applications such as solar cells, transistors, LEDs, and biomedical imaging. Here in the E.N.S.E.R. laboratory, we have been investigating the kinds of materials that can be made with QDs.

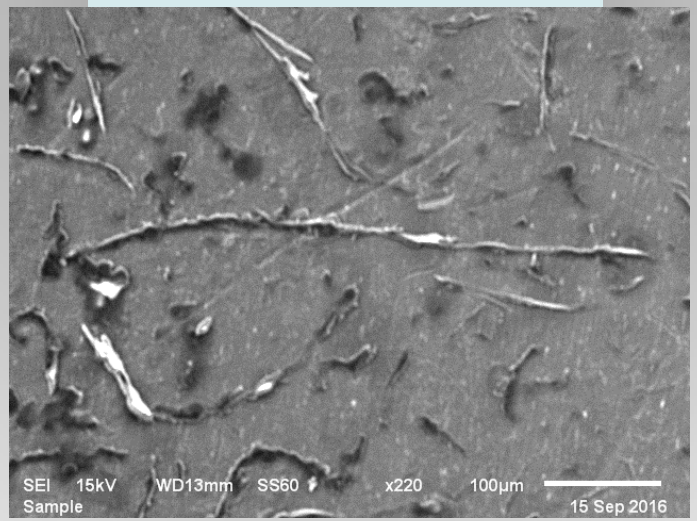


Tunneling electron microscope in scanning mode image of an isolated nanorod composed of QDs

Using DNA Strands as Glue



The images below and on the previous fold show some rod-like structures made up of QDs. These images were taken with microscopes that use electrons instead of light. The QDs are held together using strands of DNA that act like glue. One type of QD can be coated with one half of a DNA strand, and another type of QD can be coated with the other half of a DNA strand. When these now coated QDs are mixed, they self-assemble into larger structures.



Scanning electron microscope image of some "dirty" rods in bulk.

Optical Tweezers

A modern day tractor beam!

The optical tweezers at UNC uses an infrared laser to create forces on microscopic objects. It can be used for force measurements and positional control on objects as small as half a micrometer. It is a gentle, non-intrusive tool used for a wide range of sciences, including material science and biology.

Taken from www.thorlabs.com

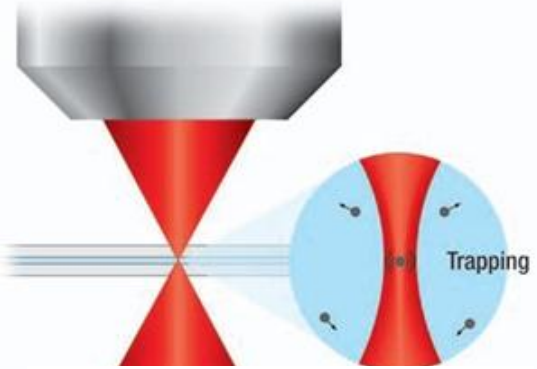


Diagram showing a microscopic object trapped by the infrared laser

Experiment

The optical tweezers is currently being used to study the spring-like properties of DNA. A strand is attached between two glass beads (~.5 µm); one is fixed in place with a glass micro-pipette and the other is trapped with the optical tweezers. The tweezers moves the bead, stretching the DNA and measuring the resulting forces.