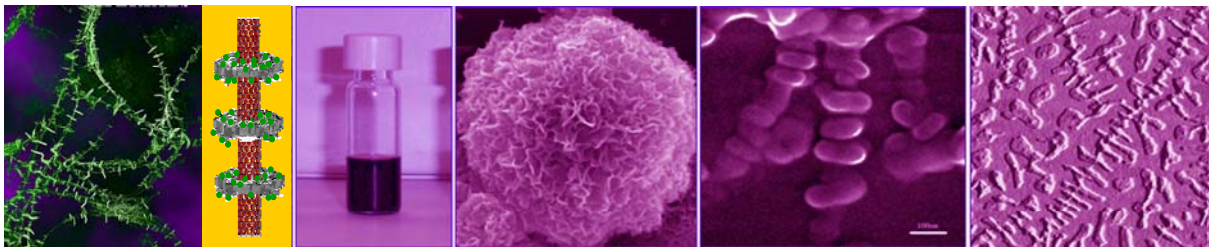


**EXPLORE THE SOFT WORLD (CHRISTOPHER LI): SOFTER is BETTER!!!** What is common between a laptop display and a piece of artificial muscle? The materials! Since both the display and the artificial muscle are based on a class of new materials called liquid crystals, which behave like crystals (such as ice) but can also flow like water. Liquid crystals belong to a new category of material called “Soft Matter”. Soft Matter refers to materials having complex structural and dynamic properties intermediate between those of crystals and fluids. Other materials belonging to this category are **polymers, colloids, gels** and **foams**. Yes they are all SOFT! The SOFTNESS renders some fascinating properties of these materials which make them unique and very useful. For the laptop display, liquid crystals are used since they can change their orientation under a tiny electric field, which leads to the contrast a display would need. This orientation change can also be brought to macroscopic scale, and can be used to fabricate an actuator, as in artificial muscle case. Thus, Soft Matter is also considered as “actively adaptive materials”. Our research interests center on micro engineering of soft matter and hybrid materials (focusing on **POLYMERS** and **LIQUID CRYSTALS**) at the nanometer scale. Numerous different research opportunities are available with emphases on their structural, photonic and biological applications. Two examples are: (Detailed information can be found at <http://www.mse.drexel.edu/srg/research.html>)



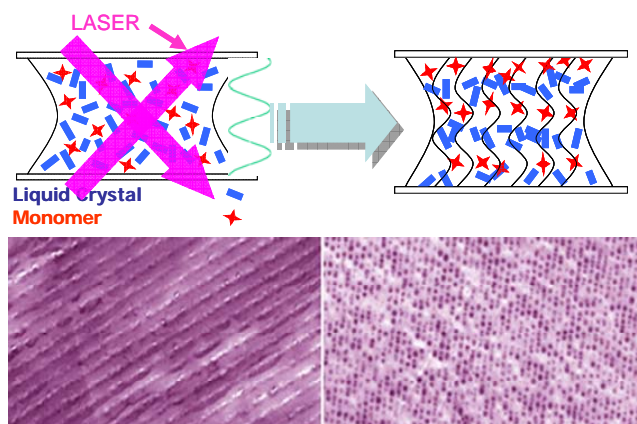
Nano shish kebabs obtained in CYL lab. This unique material could be used to make stronger materials, more sensitive sensors and more efficient photovoltaic cells.

### Case 1: Shish Kebab Goes Nano

What is your dream research work? How about making a shish kebab which is a few millionths of a human hair? We developed this unique material by combining carbon nanotubes (CNT, really small hollow tubular carbon) and some specific polymers (like those used to make your soccer jersey) as shown in the above figure. What is it good for? Well, sure it's not for your dinner. This unique material combination renders a novel means to functionalize CNT and make them useful in many different fields. Examples are composite materials which make Boeing 787 lighter and more fuel efficient. The extremely high surface area also makes it an ideal candidate for building sensors, photovoltaic cells, etc.

### Case 2: Hologram and Hierarchical Nano-Manufacturing

Holograms are cool but do you know the same principle can be used to create Hierarchical nanostructures? Hierarchical nanostructures are materials with orders at different length scales, similar to proteins. They are of great interest from both scientific and technological viewpoints. They are, however, difficult to fabricate since most nanomanufacturing techniques can only be used to produce structures at a certain (narrow) length scale. To address this need, we combine holographic polymerization and block copolymer self assembly techniques to create active, tunable hierarchical nanostructures. Structures such as Bragg Reflectors (BR) have been made by shining lasers on some “custom-made” syrups in our lab as shown in the right side figure. These BR can be used for optic devices as well as goggle filters to protect soldiers from laser guns!



Bragg Reflector by Holographic Polymerization