Zachary Kallenborn, Philosophy

University: Northwest Missouri State University
Year in School: Sophomore
Hometown: Kansas City, MO
Faculty Mentor: Dr. Peter Pfeifer, Physics & Astronomy
Funding Source: Missouri Academy

Hockey pucks: The energy of the future

Z. Kallenborn, M. Woods, and P. Pfeifer

No, not the traditional hockey pucks the Canucks play the sport they love with. These hockey pucks are much like sponges; they are blocks of activated carbon filled with incredibly small pores whose diameters measure only several nanometers. But what is more interesting is that these pores have an unparalleled ability to store natural gas. When the carbon is immersed in methane or hydrogen (the two primary gases that All-Craft is working with), the gas molecules becomes stuck inside the pores. Due to Van der Waals forces, a potential energy well is created in the pore allowing the molecules to become strongly bound. For most intents and purposes, these pores are cylinders. Using this fact, I looked at SAXS (Small-angle X-ray Scattering) data which allows us to "see" the pore structure inside the block. Different pore geometries scatter differently. By looking at the graph of the scattering and applying a nifty equation, one can determine the shape and volume of that pore. But what we're really interested in is not the volume of the pore but its radius and length. Most of my time working was spent looking at different ways to attempt to determine the radius and the length of the cylinder. Initially it was believed that the length of the cylinder could be determined from the "knee-point" of the graph. I showed that this was in fact not the case. I developed and tested many other methods for determining the radius and length of the pores. Most of these various methods involved some sort of interpolation of all the data into an equation.