Bob Bell

Biography

My name is Bob Bell and I grew up just north of Houston, Texas. I received a BS in Physics from University of Texas at Austin (UT) and I'm currently finishing the third year of my PhD in Material Science and Engineering here at Cornell.

I've always loved to tinker with things. Growing up, I was fortunate to have parents who were science enthusiasts, and my father often applied his experience building houses towards building hovercrafts, arc lamps, and other gizmos with me. I paid for college by working construction near Houston, and later embraced the life of college student, air-conditioning and all, for all it was worth.

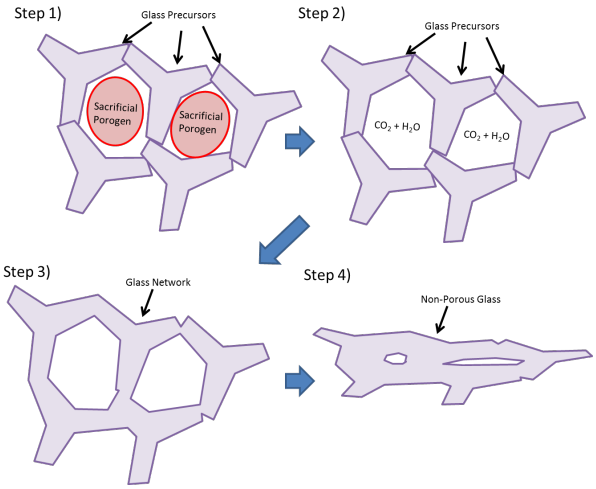
During my first couple of years in UT physics the student retention rate was terrible. Nearly half of the students entering as physics majors their freshman year would leave the department to pursue other science and liberal arts majors by the time they'd reached upper division courses. During the summer before my junior year, I was relaxing after doing some outreach when I had an idea. At the start of the next semester, while the incoming physics students were still enthusiastic about attending department events, I advertised in all intro classes that anyone who wanted to was welcome to come play with liquid nitrogen and listen to a pitch about outreach. By the end of the semester, physics volunteers were flooding all of the department's outreach events to the point where often there was nowhere to put the volunteers. As a result of my efforts, I was hired by the department as the undergraduate research coordinator, and I was tasked with organizing events, making demos, and recruiting new volunteers. Consequently, outreach exploded in the department, and by the time I graduated a new cadre of incredibly motivated students were working on expanding outreach even further.

Upon arriving in graduate school, the flexible hours put me in a position where there was always something work-related to do. I still volunteer, but at a much reduced capacity than I used to. There are some graduate students who do an incredible job balancing work and outreach, but I've been less successful. I am very much looking forward to working with teachers and students more often.

Research

My research specialty is using lasers to heat materials to very high temperatures, thousands of degrees if I don't mind vaporizing the samples, for extremely short periods of time. Here, a short period of time refers to 1 millisecond to 10 nanoseconds of rapid heating before the sample is quenched back to room temperature. On time scales this short, atoms don't move very far, even when they have a huge amount of thermal energy. This allows us to re-order a material's local structure without having to worry about things, like phase separation or pore collapse, that require bulk movement of atoms

Up to this point in my graduate career I have worked on porous glass materials for use in packaging the wires on semiconductor devices in a way that minimizes interference between wires. Cross-wire interference decreases the speed of computers. To make this glass porous, two components are necessary, glass precursors and sacrificial porogens (Step 1). The material is heated in order to decompose the sacrificial porogen into CO_2 and H_2O that then diffuse out of the glass (Step 2). This heating also fuses the glass precursors, much like grains of sand melting, to become a network of glass (Step 3). The trick when making these materials is to make the precursors hot enough to fuse together but not hot enough to lose porosity as pores sag (Step 4).



My future work will use these same techniques of controlling structure and phase and apply them to making catalysts for fuel cells. Much like making the porous glasses, the catalyst materials need to be heated and fused together without large scale atomic movement.