Adam Hock

I'm a Chemist.

I am a chemistry professor at Illinois Institute of Technology. My areas of research are devoted to enabling a sustainable and vibrant future world. Our work includes catalysis (the art of developing new materials and molecules that make reactions proceed faster, more selectively, or both), solar energy conversion (solar cells), as well as electronic materials for next-generation computers and other devices (cell phones etc). Our group has one big interest in common: the ability to assemble these materials with near atom-level precision. This is termed chemical synthesis and is the way everything from lifesaving medicines, rust-resistant bolts, computer chips, and nearly all other high-tech goods are made. Understanding how chemical reactions proceed and what products come out is critical to designing new molecules and reactions that achieve our goals of a sustainable and healthy society for centuries to come.

Chemistry often brings to mind bubbling beakers, pretty colors, and stirring liquids. Our work definitely has all of these and more…we also work with materials that react with oxygen and water in the air. Due to this reactivity, a lot of our reactions are conducted in steel, glass, or other enclosures under nitrogen (the major component of air) that has been purified to remove the oxygen and water to part-per-million levels. That allows us to use these very reactive substances to make new materials that have better properties than the ones currently used as catalysts, in your computer, or solar cells.

Current Projects

One of the biggest projects right now is devoted to making new molecules and processed to build faster and better computer chips. This included the storage/memory parts AND the processors that do the actual computing, as well as the power handling parts. We work with teams to achieve these goals that include physicists, materials scientists, and electrical engineers to design and build new computing devices literally from the atoms up. We also use this approach to work on new materials for solar cells, which convert light into electricity and are a critical part of a renewable society.

The other main portion of our work is studying new catalysts used to make the raw chemical feedstocks that enable other parts of a modern society. By making new catalysts that are faster we can produce more material with less energy. We also work to understand how to design and make catalysts more selective so we get more of the desired products and produce less waste.

What do you think?

How can new materials and approaches to manufacturing be made more sustainable? How does the structure of individual atoms affect the properties of the final material or molecule? How can we use new tools to study chemical reactions and molecules so we can achieve the first two goals?

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