Chemist Develops Synthetic Materials for Energy-saving Applications

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A chemist at The University of Texas at Arlington is working to create new synthetic materials that can improve on inorganic metal oxides for use in a variety of energy-saving applications.

Robin Macaluso, associate professor of chemistry and biochemistry, recently received a two-year, $250,000 grant from the National Science Foundation's (NSF) Division of Materials Research to fund the research. She is principal investigator of the project, "New Oxysulfide Perovskites for Photocatalytic and Photovoltaic Applications."

The goal of the study is to develop new materials that can make a positive impact in solar energy technology and ultimately help address society's ever-increasing need for reliable sources of alternative energy. It will focus on establishing a method to create synthetic versions of sulfide and oxysulfide perovskites. (Perovskites are a class of materials that share a unique crystalline structure and chemical formula.) This material would then act as a semiconductor that transports the electric charge that's created when light hits it.

Oxide perovskites are the most well-known and common perovskites because they are stable and generally composed of highly abundant elements. But they are not typically semiconductors. The primary challenge is to control semiconducting behavior while maintaining the stability and use of abundant, non-toxic elements, Macaluso said.

"This project is interesting because we're trying to combine oxygen and sulfur with the metal and make new materials called metal oxysulfides," Macaluso said. "One major limitation of some conventional perovskites is that they cannot efficiently absorb and store solar energy. The motivation for synthesizing sulfide and oxysulfide perovskites is to establish stable inorganic materials with improved efficiency. Hopefully we can use these to make new

semiconducting materials that are stable so we can utilize them in more applications or make them so they can be exposed to more humidity or warmer or colder temperatures."

This is a relatively new and emerging area of research, Macaluso said. Scientists do not have a set protocol for how to make these materials, and there are very few mixed anion materials.

Fred MacDonnell, professor and chair of the UTA Department of Chemistry and Biochemistry, said Macaluso's NSF-funded project has the potential to provide substantial improvements in the semiconductor field.

"One of the challenges we face as scientists is finding ways to make energy sources more efficient and cost-effective," MacDonnell said. "The research Dr. Macaluso and her students conduct in this project could bring about much-improved stability and energy storage capability in the compounds with which they're working."

Read the original article on The University of Texas at Arlington.