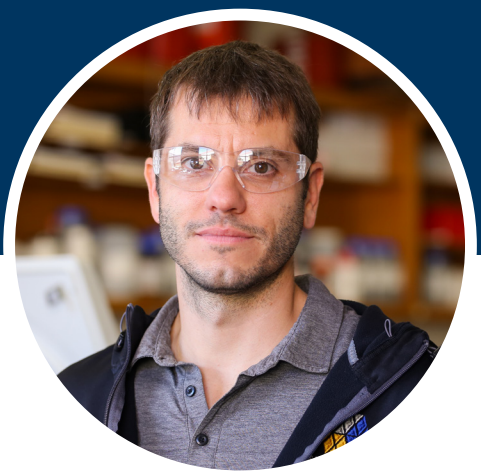
Making Sticky Notes Sustainable: A UCSB-BASF Collaboration



Chris Bates

Most of us don't think much about the glue on the back of sticky notes. We write on them, stick them, peel them, and, eventually, toss them. Global chemical giant BASF, on the other hand, is putting a great deal of time, effort, and consideration into the subject. Chris Bates, an associate professor in the Materials Department at UC Santa Barbara and an expert on polymers who is working on a project with BASF, explains why.

"BASF came to us with a problem," he says. "They are a big maker of the material on the back of a sticky note, called a pressure sensitive adhesive, and many other kinds of adhesives. They're carefully engineered and very effective, but they're not very sustainable. Now there are regulations coming out of Europe, in particular, saying that all polymers used in such adhesives have to be degradable, sustainable, and recyclable. BASF needs a solution to that business challenge, so they asked us to help."

For the past two years, Bates has worked with a BASF adhesives expert, as well as with UCSB colleagues including chemistry professor Javier Read de Alaniz, chemical engineering professor Michelle O'Malley, and Patricia Holden, a professor and microbiologist at the Bren School of Environmental Science & Management. The project is one of roughly forty that are part of CARA, the California Research Alliance, an umbrella organization created by BASF that links the company with researchers at universities across California.

CARA has a few full-time program managers, including Rohini Gupta, who connected Bates and BASF. "The program managers serve as a kind of matchmaker in that they might say to BASF, 'Oh, the Bates group does a lot of polymer-chemistry materials. Who in BASF has a materials problem that would rely on polymer chemistry for the solution?' And they find an expert," Bates says. "Ours is Matthias Gerst, in Germany, an absolutely world-class expert who spent his career working on adhesives at BASF."

The approach that researchers in Bates's lab took to address BASF's challenge arose out of some graduate students' curiosity-driven experiments with lipoic acid, an inexpensive antioxidant dietary supplement. "It's found in your body bound to proteins," Bates says, "and you can buy a kilogram of it from Amazon for about a hundred dollars."

The work had been started by a postdoctoral researcher in the group who is now a professor in South Korea. "At the time he was here, we were thinking about degradable elastomers, but we didn't have a connection to a real-world problem," Bates recalls.

BASF's request provided that connection. "That's what I love about this story. As an academic, it's easy to sit in our office, invent a problem, and try this or that," Bates says, "but people in industry are really level-headed. They have a real profit-driven issue, and if you can solve it, you can potentially make an impact in the real world."

He continues: "So they came and said, 'This is the problem. Do you have any ideas?' It was kind of a light bulb moment when you say to yourself, 'Oh, we're thinking about degradable polymers over here, and they're interested in degradation. Could we somehow combine these to use lipoic acid, but in the context of adhesives?' It turned out to work really well. It's great when you have some fundamental creativity-driven research and then industry involvement, which gives you the practical constraints."

Bates's group found that they could sprinkle some lipoic acid into the polymerization mix for the adhesives without changing their normal properties, making it possible later to chemically break the polymers down into very small repeat units. Then, Bates notes, "You can either degrade the polymers by taking them out of the supply chain and trying to recycle them, much as we would recycle plastic, or we could put it into a special bin and capture it somehow."

The work has generated a patent filing, with a BASF collaborator as a co-author on it, Bates says, "Because they've been an integral part of the research. They didn't just give us the money and say, 'Go.'"

That is why, he says, "The collaboration is a win-win, and there are outcomes beyond the science. It's a pipeline for employment for our graduate students, but it also raises our profile among people who can support research and the students who do it at UCSB. Some sixty-eight students have been involved in CARA projects at UCSB over the past few years, including numerous NSF fellowship holders who are engaged in the research that pays for their PhD studies. BASF might find one student 'on paper,' but they also get many more students working on the project because of leverage like this."