Q&A: Researchers develop sustainable new adhesives for industry

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Karan Dikshit. Credit: University of Colorado at Boulder

Karan Dikshit (Ph.D.MatSci'22) is the first author on a paper in *ACS*

Applied Materials & Interfaces that introduces new adhesive materials that not only allow for easy sticking and unsticking but could eventually contribute to sustainability efforts around the globe.

Dikshit studied polymer chemistry and mechanics with Assistant Professor Carson Bruns during his time at CU Boulder in the Material Science and Engineering Program. We asked him about the paper, his current job, and more.

What was your area of study in the College of Engineering and Applied Science and how did you get to Boulder?

Dikshit: Prior to joining CU Boulder I had the incredible opportunity to gain research experience at the esteemed National Chemical Laboratory in India. It was during this time that my passion for scientific exploration and making a positive impact on the world through sustainable materials grew immensely.

When I was considering my next academic step, CU Boulder stood out as a beacon of cutting-edge research and innovation—particularly in the fascinating intersection of sustainability and soft materials. It also boasted a stunning location nestled against the picturesque backdrop of the Flatirons which also helped me decide to come here.

I got my Ph.D. in Materials Science and Engineering in the summer of 2022. Currently, I have the privilege of working at FLO Materials, a company dedicated to tackling the pressing issue of industrial plastic waste, in Berkeley, California. FLO Materials aims to revolutionize the field by offering groundbreaking platform technology that enables the creation of infinitely recyclable polymers.

How would you describe the work and results of this paper to a high school student?

Traditional adhesives are often derived from petroleum refinement and are difficult to dispose of in a way that isn't harmful to the environment. New eco-friendly materials such as lipoic acid, cyclodextrin, and polyrotaxane—as we discuss in the paper—also stick together and have other advantageous properties like easy removal without leaving residue or harming the surfaces involved.

These materials are also made from molecules that can be bioderived. Cyclodextrin, for example, comes from plant starch. Utilizing renewable resources like that helps reduce dependence on fossil fuel-based options and the sustainable nature of the materials also opens the possibility of recycling them in other applications to further reduce waste generation.

What are some of the other potential applications of this research?

The broad range of real-world applications for these pressure-sensitive supramolecular adhesives is incredibly promising. In the medical field, these adhesives have the potential to revolutionize wound care by providing gentle yet secure bonding in bandages and dressings. Their pressure-sensitive nature also allows for easy and painless removal, enhancing patient comfort during the healing process. And in the realm of electronics, they offer exciting opportunities for the development of flexible circuits.

Anything else you want to say about your time at CU Boulder?

In addition to the lab work, my time at the University of Colorado Boulder brought significant personal growth and development. Engaging in research, attending conferences, and participating in seminars allowed me to step out of my comfort zone and embrace new challenges. Presenting my work to a wider scientific community also enhanced my communication skills and confidence in sharing my research findings with others.

These experiences not only deepened my knowledge but also sharpened my critical thinking and problem-solving abilities. Beyond the academic realm, I had the opportunity to collaborate with diverse individuals from various cultural backgrounds. These interactions enriched my perspective and fostered a greater appreciation for different approaches and ideas. Being part of a supportive and collaborative environment encouraged me to become a more effective team player, building strong relationships and learning from the expertise of my peers.

More information: Karan Vivek Dikshit et al, Pressure-Sensitive Supramolecular Adhesives Based on Lipoic Acid and Biofriendly Dynamic Cyclodextrin and Polyrotaxane Cross-Linkers, *ACS Applied Materials & Interfaces* (2023). DOI: 10.1021/acsami.3c00927

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