Laser-scribed disordered graphene significantly improves sodium-ion battery capacity

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The team formed a polymer (urea-containing polyimide) sheet on copper and then exposed this sheet to strong laser light. By introducing nitrogen gas during the process, the team could replace some of the carbon atoms with nitrogen atoms, reaching an extremely high nitrogen level (13 atomic percent), which is unattainable by other techniques. Thus, the three-dimensional graphene was more conductive, had expanded atomic spacing, and was directly bonded to the copper current collectors, eliminating the need for additional processing steps.

"We wanted to find a way to make three dimensional hard carbons without having to excessively heat our samples. This way we could form the hard carbon directly on copper collectors," said Fan Zhang, a Ph.D. student in Alshareef's group.

The KAUST researchers fabricated sodium-ion batteries using their laser-formed anode material. Their device exhibited a coulombic efficiency that exceeds most reported carbonaceous anodes, such as hard and soft carbon, and a sodium-ion capacity better than most previous carbon anodes in sodium-ion batteries.

"I enjoyed learning from every member of Prof. Alshareef's group, especially Fan Zhang, who was my closest mentor," said Eman Alhajji, a KAUST Gifted Student Program (KGSP) intern and current undergraduate student at North Carolina State University, USA. Eman will join the group as a Ph.D. student next fall.

"Zhang and Alhajji set an admirable example of productive collaboration between KAUST graduate students and visiting KGSP interns. Their work opens a new direction in battery research, which can be extended to other energy-storage..."
technologies," said Alshareef.


Provided by King Abdullah University of Science and Technology


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