New research directions in disordered carbon anodes for Na-ion batteries

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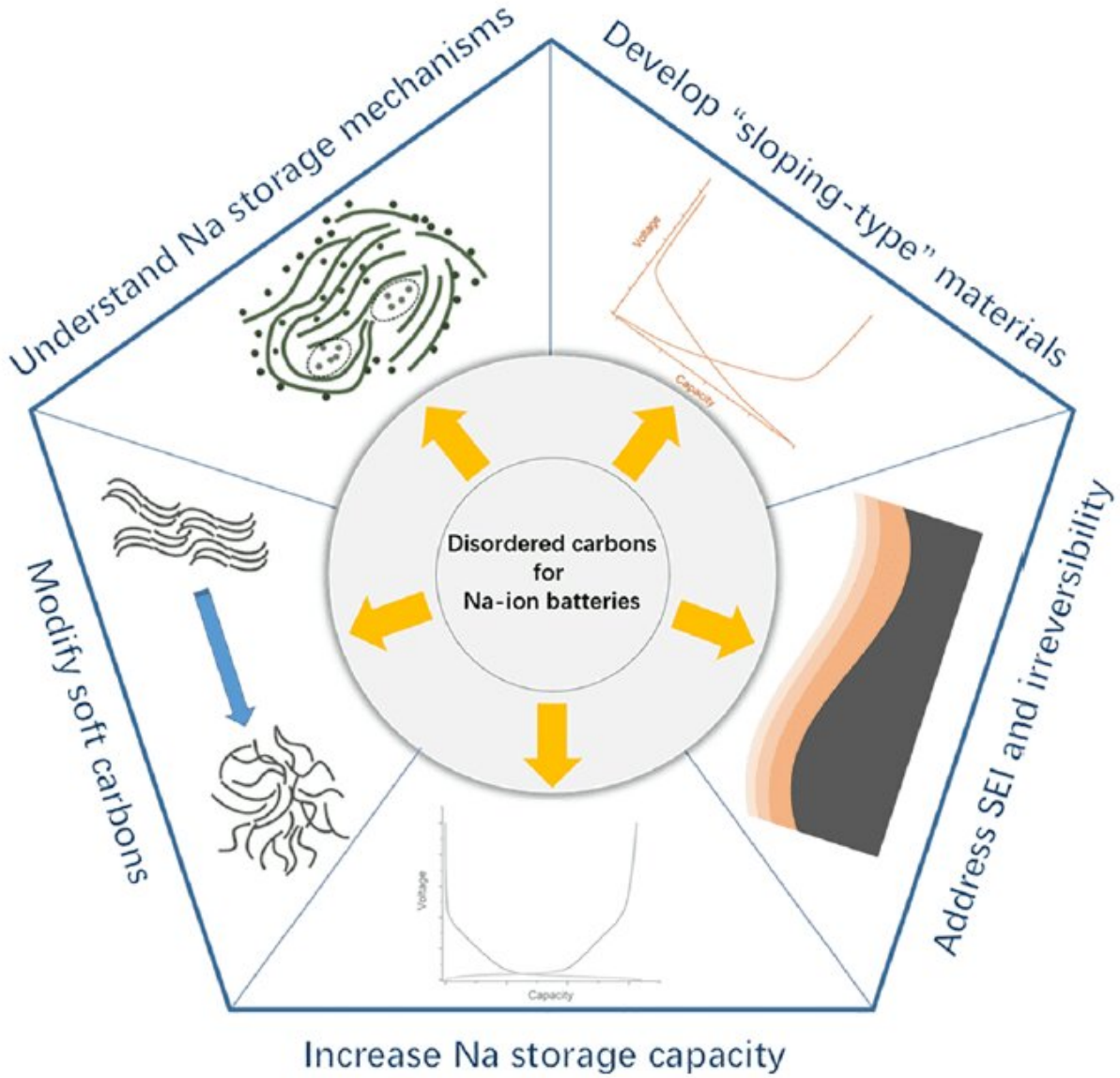

Disordered carbon anodes for Na-ion batteries—quo vadis? Credit: Science

Na-ion batteries (NIBs) are gradually attracting much attention as an alternative to lead-acid batteries and supplement to Li-ion batteries (LIBs) owing to the abundant Na resources and excellent cost-effectiveness. Since the most commonly used graphite as an anode material in LIBs cannot be inherently used in NIBs, tremendous efforts have been made to advance the fundamental understanding and design of suitable anode materials for NIBs, including the improvement of Na storage capacity and the study on Na storage mechanisms. According to all these studies, disordered carbons are now the most promising anode candidates for NIBs. Nevertheless, there are still many challenges need to be addressed, and the further exploration of disordered carbon anodes is very important in the future.

Recently, Prof. Yong-Sheng Hu and Prof. Yaxiang Lu from Institute of Physics, Chinese Academy of Sciences systematically reviewed and proposed the future research directions of disordered carbon anodes for NIBs and discussed the current progress and remaining challenges.

The authors first summarized the milestones of the studies on disordered carbons for Na storage during the last decades, while there are still many challenges and unsolved questions. The authors proposed 5 main research directions on disordered carbon anode materials:

1. Understanding the current controversies and depicting a complete picture of Na storage mechanisms in disordered carbons;
2. Developing hard carbon anode materials with ultrahigh Na storage capacity over 400 mAh/g;
3. Developing "sloping-type" carbons towards high-power and safe

NIBs;
4. Modification of soft carbons for high cost effectiveness;
5. Understanding the solid electrolyte interphase and improving the initial Coulombic efficiency.

The current research progress for each direction was summarized, and the remaining challenges were discussed. The authors also provide possible solutions for each direction. Early researches have well laid the foundation of the study of disordered carbon anodes for NIBs and paved the road from lab to commercialization. The authors believe that further research is needed to solve the remaining questions and breaking the bottlenecks of the disordered carbon anodes will put NIBs a great forward.

The review article has been published on *Science China Chemistry*.

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