DREXEL UNIVERSITY
Materials Science and Engineering
College of Engineering

Department of Materials Science and Engineering,

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MXenes as passive components in electrochemical energy storage

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Abstract

The growing need for renewable energy integration and portable electronic devices has made high-performance energy storage devices more crucial than ever. While most research has concentrated on developing cathode and anode active materials in batteries, passive components such as current collectors, conductive additives, binders, and separators play an equally important role. These components, often overlooked, constitute around 20% of each battery cell. As active materials approach their theoretical performance limits, there is increasing interest in optimizing passive components to reduce battery weights when developing high-power batteries. To improve battery energy efficiency, it is essential to substitute traditional materials with lightweight alternatives. MXenes, a family of two-dimensional transition metal carbides, nitrides, and carbonitrides, have emerged as a promising solution due to their excellent electrical conductivity (up to 25,000 S/cm), high surface area, good mechanical properties, and ease of solution processing. Herein, I will explore the potential of MXene to replace traditional battery passive components. Additionally, I will address the role of passive components and the possibilities that MXene offers as replacements, providing examples of the use of MXene as passive components.