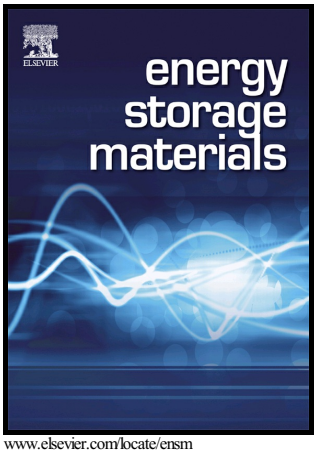

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PII: S2405-8297(18)30482-3
DOI: https://doi.org/10.1016/j.ensm.2018.05.003
Reference: ENSM387

To appear in: *Energy Storage Materials*

Received date: 19 April 2018
Revised date: 1 May 2018
Accepted date: 2 May 2018

Cite this article as: Chuanfang (John) Zhang and Valeria Nicolosi, Graphene and MXene-Based Transparent Conductive Electrodes and Supercapacitors, *Energy Storage Materials,* https://doi.org/10.1016/j.ensm.2018.05.003

Graphene and MXene-Based Transparent Conductive Electrodes and Supercapacitors

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Abstract

The great popularity of portable, smart electronics has intensively stimulated the development of energy storage devices and other cutting-edge products, such as displays and touch panels. Interactive devices such as smart phone, tablets, and other touchable devices require mechanical robust transparent conductive electrodes (TCEs). Developing transparent supercapacitor as the power source is of significance to the next generation transparent electronics. Recently, graphene and MXene, the two representatives in the large two-dimensional family, have shown excellent electronic conductivity and attracted great research attention in the energy storage field. Importantly, high-performance TCEs are the prerequisite of building transparent supercapacitors. This review provides a comprehensive analysis of graphene and MXene-based flexible TCEs covering detailed thin film fabrication methods, evaluation metrics, performance limitations as well as approaches to beat these limitations. We especially focus on the fundamentals in the TCEs, such as figure of merit, percolations as well as conductivity behaviours. Graphene and MXene-based transparent supercapacitors are analysed, with a particular focus on transparent, freestanding graphene papers. Finally, the challenges and prospects of MXene for TCEs and transparent supercapacitors, in conjunction with a critical analysis of MXene shortcomings, are discussed.

Keywords: transparent conductive electrodes, graphene, MXene, transparent supercapacitor, figure of merit

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