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All Redox-Active 2D MXene and 0D Phosphomolybdic Acid Nanoclusters-Anchored Polypyrrole Nanotubes for High-Performance Aqueous Hybrid Supercapacitors


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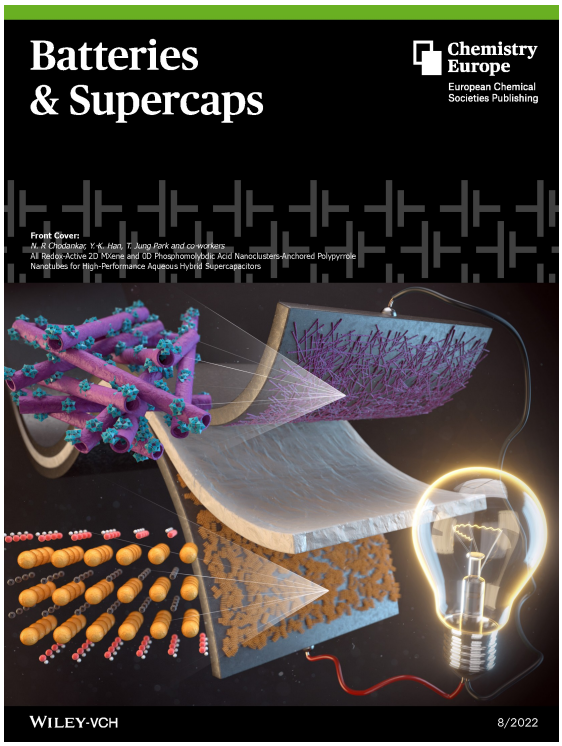
Invited for this month's cover picture is the work of a collaboration group led by Professor Tae Jung Park, Dept. of Chemistry, Chung-Ang University, Republic of Korea. The work depicted in the cover picture is a high-performance aqueous hybrid supercapacitor based on all redox-active 2D MXenes and 0D phosphomolybdic acid nanocluster-anchored polypyrrole nanotubes. The resulting device showed a specific energy of 36.1 Wh kg^{-1} and a specific power of 6.66 kW kg^{-1}, with good stability over 5000 charge-discharge cycles. Read the full text of the Research Article at 10.1002/batt.202200108.

What prompted you to investigate this topic/problem?

The construction of a hybrid supercapacitor (HSC) with 2D $Ti_3C_2T_x$ MXene anode is restricted by the scarcity of promising cathode materials that can balance its performance in protic electrolytes. Balanced properties of materials on both electrodes are necessary to make a device with superior electrochemical features. In this regard, we prompted to investigate an alternative material, which is conducting polymer nanocomposites, as they have promising inherent properties and are easy to synthesize as well (compared to metal-oxide based materials).

What is the most significant result of this study?

The most significant result of this study is the successful fabrication of MXene-based hybrid supercapacitor with the proposed conducting polymer nanocomposite, 0D phosphomolybdic acid nanoclusters-anchored polypyrrole nanotubes. The maximum power density exhibited by the device showed an excellent value of 6.66 kW kg^{-1} with good capacitance retention and good stability as well. The contribution of the nanocomposite in achieving this improvement is also pin-



pointed and provided with data in this study, where the 0D phosphomolybdic acid nanoclusters that decorated the polypyrrole nanotube plays the key role in increasing the supercapacitive performance and stability of polypyrrole nanotube, making them a proper match for MXene to be used as hybrid supercapacitor electrode materials.

Does the research open other avenues that you would like to investigate?

Yes. The findings of this study imply that conducting polymers, especially their nanocomposites, are promising materials to be used in high-performance supercapacitors. Conducting polymers themselves might not be enough as they have structure pulverization problem. The exploration of other nanocomposites of conducting polymers to make a superior supercapacitive material is the opened avenue that we would like to investigate in the future.