Influence of surface terminations on intercalation, colloidal, and swelling properties of $Ti_3C_2T_z$ MXene

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Thesis Proposal

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Zoom Link:

https://drexel.zoom.us/j/82252093597

Ion intercalation between $Ti_3C_2T_z$ layers is an important phenomenon that has led to its use in various applications like supercapacitors, water filtration membranes, Li, Na, K-ion batteries, polymer composites, and many more. Several of these properties can be improved by understanding the intercalation and swelling of $Ti_3C_2T_z$ layers in various electrolytes. The understanding of this phenomenon is also important to increase the concentration of colloids than is currently possible. Studying the aggregation mechanisms of colloids can also help in the industrial-scale processing of MXenes.

In this work, we examine the effect of various processing parameters on the properties of $Ti_3C_2T_z$ MXene. The main focus is on analyzing the effect of various electrolytes on the swelling and delamination of $Ti_3C_2T_z$ layers. Further, the stability and aggregation mechanism of $Ti_3C_2T_z$ colloids is studied using zeta potential measurements as a function of pH. Finally, to enable water-free processing of MXene a new method for etching and delamination $Ti_3C_2T_z$ using organic polar solvents and ammonium bifluoride is being developed. And based on results obtained from these studies, the conventional processing parameters will be modified, and obtained $Ti_3C_2T_z$ MXene will be tested in various applications.