Department of Materials Science and Engineering,
Ph.D. Candidacy Exam

MXene Polymer Composites for EMI Shielding

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Abstract

As a new generation of technology unfolds, sources of electromagnetic interference (EMI) and pollution continue to grow exponentially. These issues can cause technological malfunctions, critical communication delays, and even human health hazards. It is becoming increasingly crucial to develop new ways to effectively shield against EMI that can not only be integrated into developing technologies, but also mitigate secondary EMI and EM pollution through absorption. MXenes, a novel class of 2D transition metal carbides, have demonstrated outstanding performance in shielding against a broad range of RF and microwave frequencies, as well as ionotronic tuning of shielding performance for dynamic applications. While MXenes still suffer from particular manufacturing, stability, and mechanical challenges, many of these problems can be remedied by compositing the nanomaterial with certain polymers. Polymer nanocomposites are incredibly useful in the EMI shielding field as their dielectric properties combined with the shielding effectiveness of the filler material typically lead to higher absorption of electromagnetic waves. This presentation examines the potential for MXene polymer composites to emerge as the new standard for EMI shielding materials due to their processability, mechanical properties, and high shielding effectiveness across wide bandwidths. The effect of MXene selection, polymer matrix, and geometries will be studied to understand how various MXenes and polymers can be utilized for a wide range of shielding applications.