

Processing of liquid-phase exfoliated 2D nanomaterials devices

Valeria Nicolosi

Trinity College Dublin, School of Chemistry, CRANN, AMBER and IForm Centres, Dublin 2, Ireland

Two-dimensional materials offer a compelling platform for the development of next-generation energy storage and electromagnetic interference (EMI) shielding technologies owing to their high surface area, tunable electronic properties, and solution processability. A key challenge, however, remains the scalable integration of these materials into functional devices while preserving the advantages of their nanoscale structure.

In this talk, I will present our recent work on the liquid-phase processing and printing of two-dimensional nanomaterials for high-performance supercapacitors, EMI shielding layers, and printed electronic components. By engineering stable dispersions and functional inks based on layered materials—including graphene, transition-metal carbides and nitrides (MXenes), and other nanosheet systems—we demonstrate scalable fabrication routes compatible with printing and coating techniques.

I will discuss how nanosheet morphology, surface chemistry, and assembly strategies influence charge storage mechanisms in supercapacitors and the electromagnetic attenuation performance of thin films and coatings. Particular attention will be given to the design of printed architectures that combine high electrical conductivity with controlled porosity and mechanical robustness. These approaches enable lightweight, flexible devices with strong EMI shielding effectiveness and high areal capacitance.

Overall, the work highlights how solution-processed two-dimensional materials can bridge the gap between fundamental nanoscience and manufacturable technologies for energy storage, electromagnetic protection, and printed electronics.