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# Electromagnetic interference shielding materials based on assembly of $Ti_3C_2T_x$ MXene

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Transition metal carbides and nitrides (MXenes), especially $Ti_3C_2T_x$ MXene, have revolutionized the field of electromagnetic interference (EMI) shielding due to the unique combination of outstanding metallic electrical conductivity and rich surface chemistry [1]. In 2017, we reported the fabrication of flexible and hydrophobic MXene foams and demonstrated that the EMI shielding performance of shielding materials can be enhanced by designing porous structures without increasing material consumption [2]. However, easy oxidation and swelling of MXene materials in water severely deteriorates their properties with time. To improve the stability of MXene materials, we then proposed a universal ion diffusion induced gelation method to synthesize lightweight, foldable, and highly stable MXene foams, in which the MXene sheets are cross-linked and stabilized by metal ions and a small amount of graphene oxide [3]. The unique cross-linking structure ensures outstanding durability and stability in wet environments. More recently, in order to enable high application adaptability and multifunctionality of shielding materials, we prepared a hydrogel-type shielding material incorporating MXene and poly(acrylic acid) through a biomineralization-inspired assembly route. The composite hydrogel demonstrates excellent stretchability and recyclability, fast self-healing capability, unique absorption-dominated shielding property, and sensing ability [4]. These works not only provide inspiration for developing high-performance EMI shielding materials but could also bring opportunities for extending the applications of MXenes in the 3D macroscopic form.

## References

[1] F. Shahzad, M. Alhabeb, C. B. Hatter, B. Anasori, S. M. Hong, C. M. Koo*, Y. Gogotsi*, Electromagnetic interference shielding with 2D transition metal carbides (MXenes). *Science*, 353, 6304 (2016): 1137-1140.

[2] J. Liu, H.-B. Zhang*, R. Sun, Y. Liu, Z. Liu, A. Zhou, Z.-Z. Yu*, Hydrophobic, flexible, and lightweight MXene foams for high-performance electromagnetic-interference shielding. *Adv. Mater.*, 29, 38 (2017): 1702367.

[3] Z. Lin, J. Liu*, W. Peng, Y. Zhu, Y. Zhao, K. Jiang, M. Peng, Y. Tan*, Highly stable 3D $Ti_3C_2T_x$ MXene-based foam architectures toward high-performance terahertz radiation shielding. *ACS Nano*, 14, 2 (2020): 2109-2117.

[4] Y. Zhu, J. Liu*, T. Guo, J. J. Wang, X. Tang, V. Nicolosi*, Multifunctional $Ti_3C_2T_x$ MXene Composite Hydrogels with Strain Sensitivity toward Absorption-Dominated Electromagnetic-Interference Shielding. ACS nano, 15, 1 (2021): 1465-1474.