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Two-dimensional materials and their composites for high-performance EMI shielding and hydrogen evolution reaction

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There is a high demand for the development of radar, stealth technology, information processing technologies, intelligent wireless communication, microwave ovens, and automotive industries that fulfill modern society's needs. But devices emit dangerous EM radiation into the environment, badly affecting human health and interfering with the performance of other sensitive devices. Two-dimensional (2D) materials and their composite-based materials can help reduce and control increasing EM radiation pollution by equipping electronic devices. A good microwave shield and absorber have flexible, low-energy consumption, long-term durability, corrosion resistance, wide absorption frequency range, eco-friendly, and lightweight. Furthermore, we are facing an energy crisis, the rapid depletion of fossil fuels, and associated environmental problems. Due to the fast development of the industrial and world population, energy consumption has increased and is primarily supplied by fossil fuels. However, fossil fuels produce greenhouse gasses and badly affect human health. An urgent future energy demand for green and renewable alternative hydrogen fuel that replaces fossil fuels and solves the global energy crisis and climate change with zero emissions. Various 2D materials, such as transition metal dichalcogenides (TMDCs), flexible graphene and its derivatives reduced graphene oxide, hexagonal-boron nitride, and MXenes have attracted more interest due to their unique physical, chemical, and mechanical properties. Layered TMDCs, one of the most widely studied new-class families of 2D materials, have received more research interest in the past several years. MoS_2, and WS_2 semiconductor with a hexagonal van der Waals structure, and their composites possess strong stability, high charge carrier mobility, thin thickness, large surface-to-volume ratio, good flexibility, and are used as microwave shields, hydrogen evolution reactions (HER), oxygen evolution reactions (OER), supercapacitors, and batteries.

Bio:
Jagdees Prasad is a Post-Doctoral Researcher at the National Taiwan Normal University (NTNU), Department of Physics, Taipei City, Taiwan. He received his Ph.D. degree in the School of Physical Sciences from Jawaharlal Nehru University, New Delhi, India. After that, he went to South Korea as a Post-Doctoral Researcher at the School of Chemical Engineering, Sungkyunkwan University (SKKU), Republic of Korea, through a Brain-Korea 21Plus (BK21+) scholarship. Currently, his research interest focuses on preparing some 2D materials and their composites for various applications in EMI shielding, hydrogen evolution reactions (HER), oxygen evolution reactions (OER), and batteries.