Nasurullah Mahar
Amir Al Ahmed, Abdulaziz Al Saadi
[1]*Department of Chemistry, King Fahd University of Petroleum & Minerals, Dhahran 31261 Saudi Arabia.*

Contact@E-mail (nasurullah.mahar@kfupm.edu.sa)

Ag-NPs decorated Vanadium Carbide MXenes hybrid film as efficient SERS Substrate for the sensing of Gemcitabine

Abstract

The 2D MXene materals have established the promising impact in the surface enhacned Raman spectroscopy (SERS) application. Due to excellent plasmonic and anti-fluorescent properties the Mxene could be a potential SERS substrate for the sensing of drugs. The AgNPs decorated vanadium carbide (V_2CT_x) MXenes has been proved to be excellent material due to its intermediate inter-layer spacing, short-range charge transfer (CT) and acting as Fermi level mediator between metal and drug fermi level. The numerous efforts have been madeto synthesize the V_2CTx materials with efficient inter layers space for better inter layer charge transtion and plasmonic effects. Herein, we report the synthesis and characterization of vanadium carbide sheets using environental friendly etchant (LiF+HCl). The fabricated multilayerd V_2CTx was delaminated with the novel intercalant triethylamine (TEA) which resulted in deceased interlayer spacing of 8.13 Å and enhanced the shelf life by up to six weeks. The prepared V_2CTx was treated with self-assembled silver nanoparticles (AgNPs) to fabricate the 2D hybrid materials as a potential SERS substrate for the sensing of ultra-trace quantities of anti-cancer drug gemcitabine (GMC). The developed analytical approach posed an unprecedented limit of detection of 10^{-12} M with a wide dynamic range of 10^{-4}-10^{-12} M. The AgNPs@ V_2CTx SERS sensor has achieved a Raman signal amplification corresponding to an enhancement factor of 10^9, with high sensitivity and reproducibility.