ENHANCED DETECTION OF LITHIUM BATTERY ELECTROLYTE VAPORS USING A GRAPHENE PROTECTED SERS SUBSTRATE WITH SILVER NANO PARTICLES

Maziar Moussavi[1*] (presenting author), Marjan Monshi[2], Gvidas Klyvis[1], Sigitas Tamulevičius[1,2]

[1]*Institute of Materials Science, Kaunas University of Technology, K. Baršausko St. 59, LT-51423 Kaunas, Lithuania*

[2]*Department of Physics, Kaunas University of Technology, Studentų St. 50, Kaunas LT-51368, Lithuania*

* Email: maziar.moussavi@ktu.lt

Abstract

This study presents the development and application of a novel Surface-Enhanced Raman Spectroscopy (SERS) substrate designed for the enhanced detection of lithium battery electrolyte (LiPF6 in EC/EMC) vapors. The substrate consists of silver nanoparticles (AgNPs) assembled on a polydimethylsiloxane (PDMS) template with a square lattice of 400 nm periodicity, and subsequently transferred onto a glass substrate using a polyvinyl alcohol (PVA)-assisted technique. Additionally, the substrate was partially covered with a layer of commercial graphene (Graphena) to provide protection against corrosion and enhance analyte adsorption, while the other part remained uncovered. The fabricated SERS substrate was exposed to vapors of LiPF6 in EC/EMC within a sealed Raman measurement chamber, and the resulting spectra were analyzed. The results demonstrate that while the surface lattice resonance in regular 2-D AgNPs structure is crucial for detecting electrolyte peaks, the graphene layer significantly enhances detection sensitivity, allowing for clear identification of multiple peaks. This innovative approach highlights the potential of combining noble metal nanoparticles and graphene to improve the performance of SERS substrates for analytical applications.