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Electrospun Membrane doped with Gold Nanorods for Surface-Enhanced Raman Sepctroscopy

Authors : Ziwei Wang, Andrea Lucotti, Luigi Brambilla, Matteo Tommasini, Chiara Bertarelli

Abstract : Surface-enhanced Raman Spectroscopy (SERS) is a highly sensitive detection that provides abundant information on low concentration analytes from various researching areas. Based on localized surface plasmon resonance, metal nanostructures including gold, silver and copper have been investigated as SERS substrate during recent decades. There has been increasing more attention of exploring good performance, homogenous, repeatable SERS substrates. Here, we show that electrospinning, which is an inexpensive technique to fabricate large-scale, self-standing and repeatable membranes, can be effectively used for producing SERS substrates. Nanoparticles and nanorods are added to the feed electrospinning solution to collect functionalized polymer fibrous mats. We report stable electrospun membranes as SERS substrate using gold nanorods (AuNRs) and poly(vinyl alcohol). Particularly, a post-processing crosslinking step using glutaraldehyde under acetone environment was carried out to the electrospun membrane. It allows for using the membrane in any liquid environment, including water, which is of interest both for sensing of contaminant in wastewater, as well as for biosensing. This crosslinked AuNRs/PVA membrane has demonstrated excellent performance as SERS substrate for low concentration 10-6 M Rhodamine 6G (Rh6G) aqueous solution. This post-processing for fabricating SERS substrate is the first time reported and proved through Raman imaging of excellent stability and outstanding performance. Finally, SERS tests have been applied to several analytes, and the application of AuNRs/PVA membrane is broadened by removing the detected analyte by rinsing. Therefore, this crosslinked AuNRs/PVA membrane is re-usable.

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