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Rapid fabrication of flexible and transparent gold nanorods/poly (methyl methacrylate) membrane substrate for SERS nanosensor application

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Abstract. Flexible substrates have been proposed for daily-life applications in SERS detection due to the prominent sample collection properties such as they can be wrapped around non-planar object surface. Combining the noble metals with polymers, flexible SERS substrates could be fabricated with advantages of light weight, transparency and high SERS sensitivity. Herein, we prepare a gold nanorods (AuNRs)/poly(methyl methacrylate) (PMMA) film as flexible SERS substrate by self-assembling a uniformly AuNRs array layer on PMMA template. This AuNRs/PMMA film performs excellently on thiram trace detection with the lowest detection concentration of 0.5 ppb. The fabricated substrates were applied for practical detection with cucumber by directly covering the AuNRs/PMMA flexible film on the target surface. Furthermore, the high SERS sensitivity as well as great reproducibility present a wide range of prospections for the further application of non-plane surface.

Keywords: Au nanorods; surface-enhanced Raman scattering; flexible membrane; plasmonic nanosensor; finite-difference time-domain.

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1 Introduction

Surface-enhanced Raman scattering (SERS) has been developed in analytical sciences, biological sciences, surface and material sciences due to its nondestructive analysis and ultrasensitive properties.^[1-4] Extensive efforts have focused on the exploration of the SERS mechanisms and there are two major enhancement

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