Wearable Chemical Sensors

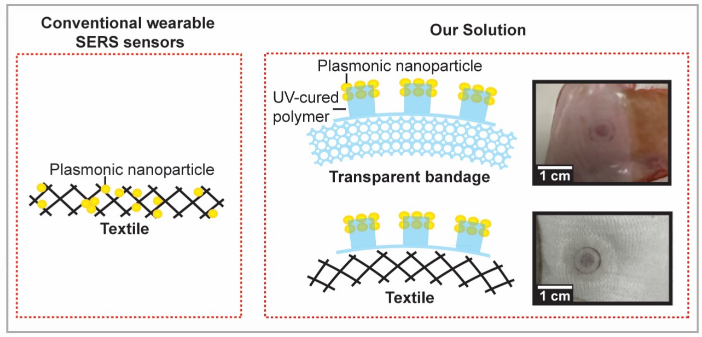
VTIP 21-001: "Washing Reusable Surface-enhanced Raman Spectroscopy Textiles and Membranes via Template-assisted Self-assembly and Micro-imprinting"

THE CHALLENGE

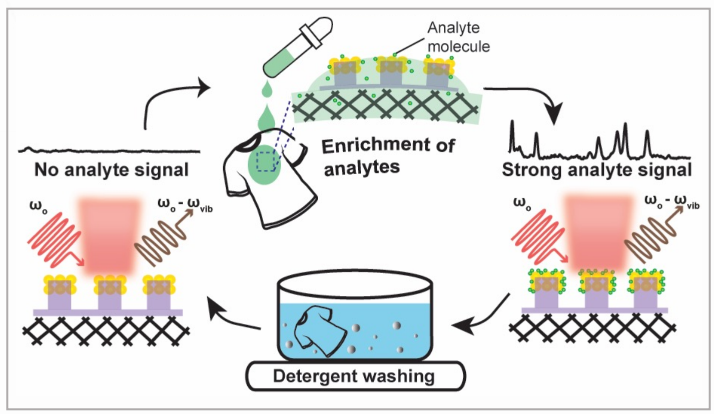
Conventionally, wearable surface-enhanced Raman spectroscopy (SERS) devices have been created by directly assembling plasmonic nanoparticles on fabrics. However, these conventional methods result in a non-uniform assembly of plasmonic nanoparticles on the fabrics resulting in inconsistent SERS sensing performance. Furthermore, these plasmonic nanoparticles are weakly adsorbed onto the fabrics via van der Waals forces resulting in low mechanical robustness of the SERS sensors.

OUR SOLUTION

This technology puts forth a strategy for robustly integrating uniformly self-assembled nanoparticles with diverse wearable substrates such as textiles and bandages for point of care biochemical sensing. The template assisted assembly process can generate a micropatch array of plasmonic nanoparticle aggregates with uniform plasmonic hotspots for consistent SERS sensing. Furthermore, these uniformly self-assembled nanoparticles can be strongly bonded onto wearable substrates by UV-cured polymer resulting in mechanically robust wearable SERS devices, allowing repeated detergent-water washing processes to clean the contaminated SERS hotspots for reusable SERS sensing.



Schematic illustrations and pictures of micropatch arrays of plasmonic nanoparticles integrated with transparent bandages and textiles.



Schematic illustration of detergent-water washing for the regeneration of contaminated SERS hotspots.

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