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Flexible nanosensors that detect food contaminants

About the Capability

- A team of IMRE scientists has developed a flexible Surface-enhanced Raman scattering (SERS) sensor with increased sensitivity that can be used to test food samples directly and detect trace amounts of pesticides.
- This was achieved by developing and depositing **anisotropic 3D metal nanoparticle inks** onto flexible substrates and created SERS sensors that have a much higher Raman enhancement effect. The signals from these sensors are about two orders of magnitude higher than those from spherical metal nanoparticles inkjet printed on some flexible substrates.
- The **flexible substrates** used, e.g. paper, offer higher surface areas which further increase the detection sensitivity of the sensors. Using the pesticide thiram as a model analyte, a sensitivity enhancement of 10^4-fold was demonstrated on the IMRE flexible SERS substrate compared with commercial glass-based SERS substrate.
- The team also **customised deposition technologies** for the IMRE-developed anisotropic 3D metal nanoparticle inks such that the inks can be deposited onto a wider range of flexible substrates besides paper, such as plastics and metal foil.
- The **deposition methods** used by the IMRE team could potentially be scaled up to meet large scale fabrication demands at a much lower cost compared with E-beam based cleanroom methods.

Potential Applications

- Faster on-site testing, detection and identification of trace pesticides and other contaminants - The flexible SERS sensors offer the possibility of **direct sampling of food, soil or water on-site,** and the use of "swab-and-test", "dip-and-test", and "in-packaging" sensing modes with minimal sample preparation steps.

Collaboration Opportunities

To partner with:

- **authorities** such as Agri-Food and Veterinary Authority of Singapore (AVA) and National Environment Agency (NEA) on developing solutions that will help in the enforcement of comprehensive quality and safety standards and testing;
- **companies in the food & beverage industry** and water-treatment industry to further research, develop and scale-up diagnostics testing applications;
- **instrumentation companies** to further develop portable detection and identification kits.

For more information, please contact:
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IMRE website: https://www.a-star.edu.sg/imre/
A*STAR website: https://www.a-star.edu.sg/

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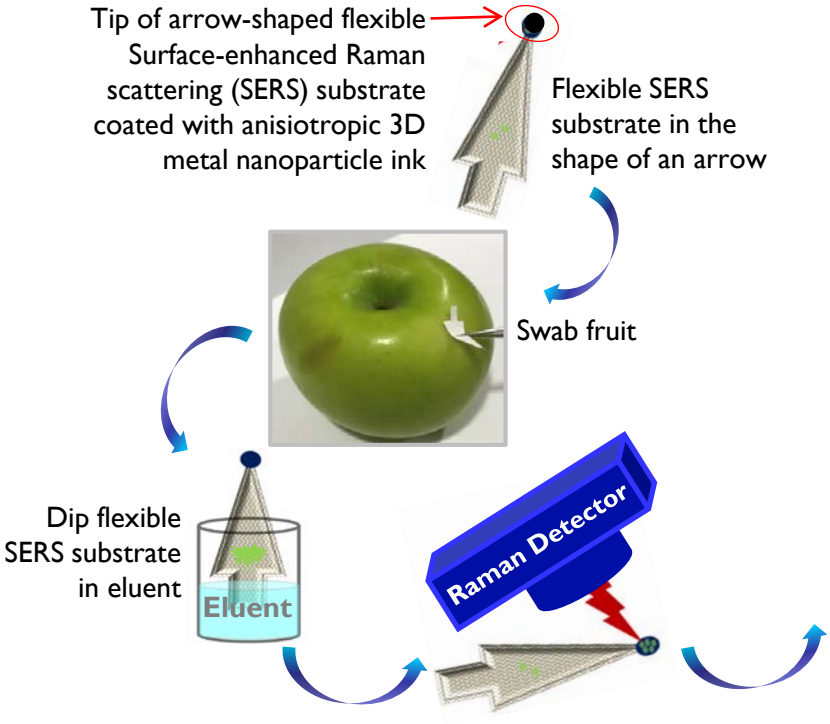
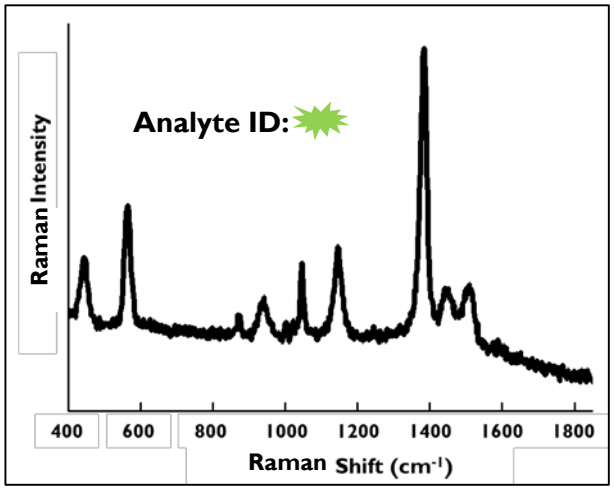
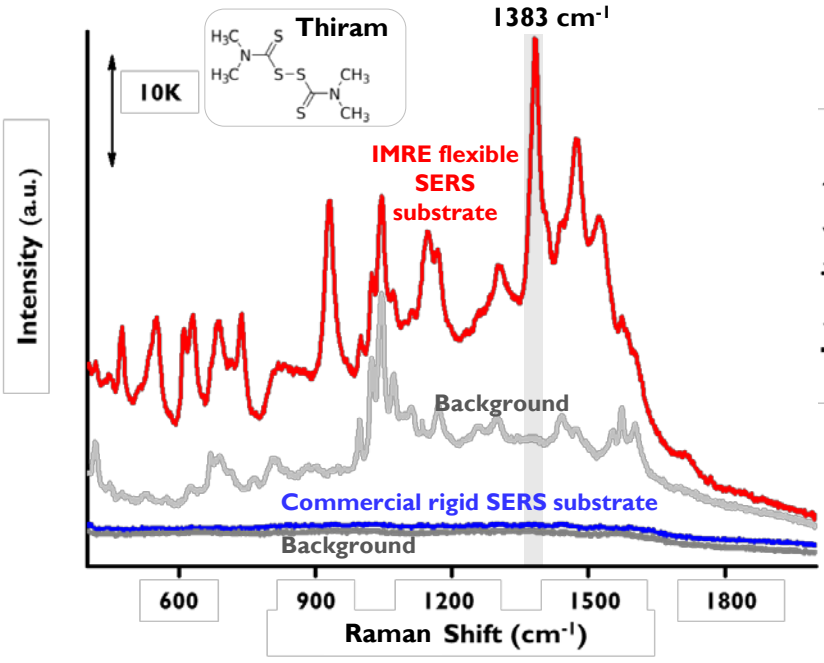
About the Process

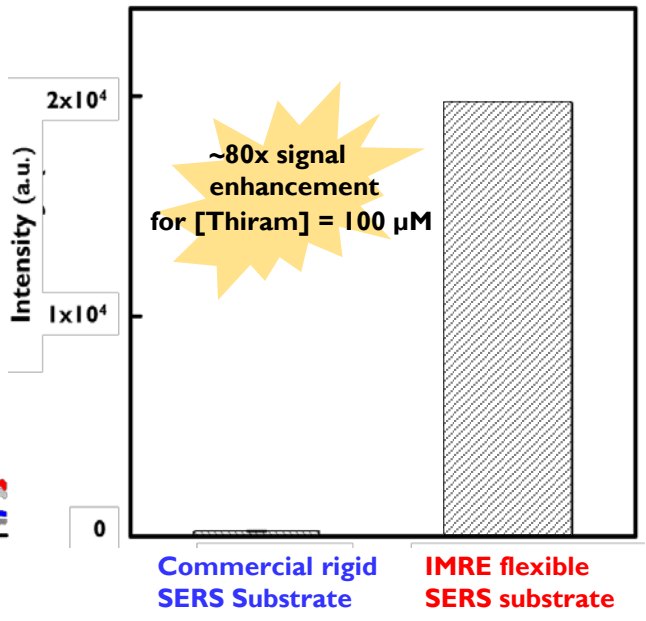
"Swab-and-Test" for trace pesticides on fruit by using paper-based SERS sensor, suitable for on-site testing:





Performance Data





IMRE flexible SERS shows 80x stronger signal enhancement for the analyte Thiram at 100 µM compared with commercial solid SERS substrate.