

## Method for Colocalization of Plasmonic Nanoparticles and Molecules with Plasmonic and Raman Scattering Microspectroscopy

### IITM Technology Available for Licensing

#### Problem Statement

- The temporal behavior of **theranostics** is vital to improve the **efficacy** in biological applications.
- Variety of **nanoprobes** are used as **theranostics** of which **plasmonic nanobiolabels** have optical, photothermal & surface enhanced **RS properties**.
- However, due to **complexity** of biological environment resulting in **multiple interfering molecules** mislead the signals.

The aforesaid problems are eased with a **combined optical microspectroscopic technique** as claimed in present patent subject matter.

#### Technology Category/ Market

##### Manufacturing/Chemical Engineering

**Industry:** Nano Technology

**Applications:** Medicine, biological applications and optical microspectroscopic technique.

**Market:** The global plasmonic materials market was around **US\$ 10.7B** in 2022, expected rising at CAGR of **15.5%** and reaching **US\$ 39.4B** by **2031**.

#### Technology

A **method** for the patent **comprising**:

1. A high resolution dark field condenser from Dark field scattering Micro- spectroscopy (**DFSMS**)
2. A Raman scattering Microspectroscopy (**RSMS**)

Wherein the high resolution dark field condenser is integrated with **conventional point-scan confocal RSMS set-up** that utilizes light source with wavelength of **400-1000 nm** to excite plasmonic modes of noble metal nanoparticles and a **532 nm laser** to excite Raman spectra for colocalization of **both** plasmonic nanobiolabels and biomolecules in biological samples.

The plasmonic nanobiolabels (**silver and gold nanoparticles**) is identified in chemical and biological nature using their inherent spectroscopic features. It is located in vicinity of **Escherichia coli** using **SERS**.

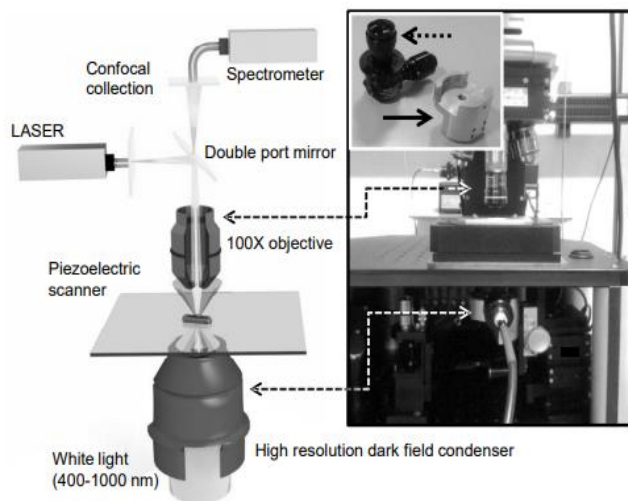
The biomolecules **includes proteins, DNA and RNA molecules**; the biological samples includes bacteria (**Escherichia coli**), mammalian cells (**HEK293 cells**).

The **plasmonic nanobiolabels** are located in **HEK293 cells** and biomolecules are colocalized with them.

The state of plasmonic nanobiolabels is identified in terms of **size, shape or state as a single, dimer or aggregated particles**.

The plasmonic & Raman scattering spectroscopy is performed on **chemical-biological systems**.

**FIG 1:** Schematic **set-up** for **correlated plasmonic and Raman scattering Microspectroscopy (PRSMS) measurements**, consisting a high resolution dark field condenser attached with conventional point-scan confocal RSMS set-up.



#### Intellectual Property

**IITM IDF Number:** 1289

**IP Patent Number:** 419154 (**Granted**)

#### Key Features / Value Proposition

- ❖ The molecules adsorbed on Plasmonic nanobiolabels surface is used for colocalization.
- ❖ **Plasmonic nanobiolabels** are important due to optical, photothermal and surface enhanced Raman scattering properties.
- ❖ To eliminate the possibility of **defocused imaging in PRSMS set-up**, care is taken to focus the desired plane of imaging by using a **laser spot** used for confocal RSMS.
- ❖ Polydisperse silver nanoparticles with **SPR centered around 410 nm** are used as nanobiolabels in Colocalization experiments, wherein **AuNPs (size ~40 nm)** are the nanobiolabels in the experiments performed on chemical and biological systems using plasmonic & Raman scattering spectroscopy.

#### TRL (Technology Readiness Level)

**TRL – 3; Proof of Concept**

#### Research Lab

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