



METALLIC MICRO-RING FOR INFRARED PULSE ASSISTED HIGHLY EFFICIENT INTRACELLULAR DELIVERY

IITM Technology Available for Licensing

Problem Statement

- Existing methods of intracellular delivery have limitations in terms of transfection efficiency, precision, and cell viability.
- Lack of a reliable and efficient method for intracellular delivery of biomolecules while maintaining cell viability.
- Need for a technique that offers **precise targeting, enhanced delivery efficiency, and non-invasive delivery.**
- Current methods often result in low **delivery efficiency or damage to cells.**
- Demand for a solution that overcomes limitations and enables successful intracellular delivery for various applications in medicine, biotechnology, and genetic research.

Technology Category/Market

Category – Biotechnology & Genetic Engineering.

Applications – Gene Therapy, Genetic engineering, Drug Delivery, Cell Transfection, Tissue Engineering, cellular therapy and diagnostics.

Industry – Pharmaceutical, Genetic Research, Biotechnology, Medical Industry.

Market - The global Nano medicine market, which includes nano-based drug delivery systems, was valued at \$215.9 billion USD in 2020. The report estimates that the market will experience significant growth and reach a value of \$661.1 billion USD by 2028, with a **CAGR of 13.3%** from 2021 to 2028.

Key Features / Value Proposition

- Metal ring microstructures using **Titanium or Gold** enable efficient intracellular delivery, while nanosecond laser pulses facilitate the delivery of biomolecules such as **dyes, plasmids, and siRNA.**
- These techniques offer, preserving **high throughput and parallel intracellular delivery** and showing potential for advancements in **cellular therapy, diagnostics, precision medicine, and genetic research.**

Intellectual Property

- IITM IDF Ref. 2265
- IN 431570 (PATENT GRANTED)

Technology

The invention provides a method for delivery of biomolecules via nanosecond pulse laser mediated photoporation. The invention also includes a process for the preparation of the metal ring microstructure and process for intracellular delivery using the microstructure.

1

•The principal of the invention is to provide the step-by-step process of **fabricating the metal ring microstructure.**The photoresist-coated substrate is exposed to **UV light** to form a **patterned photoresist substrate.**

2

•A metal layer (such as **Titanium or Gold**) is deposited onto the patterned photoresist substrate using **e-beam evaporation technique,** resulting in a metal patterned photoresist substrate.

3

•The photoresist is stripped off from the metal patterned substrate using acetone, leaving behind the metal ring microstructure. **(Fig.1)**

4

•The metal ring microstructure device is placed on **cultured cells in a petri dish.** Then the **nanosecond pulsed laser** is used to assist the delivery of biomolecules into the cells through **photoporation.**

5

•Laser pulses create temporary pores in the cell membrane, enabling the entry of biomolecules. **Delivery of biomolecules** is detected by scanning the cells using a confocal microscope with **specific excitation/emission filters.** The cells remain viable even after biomolecule delivery **(Fig. 2)**

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Images

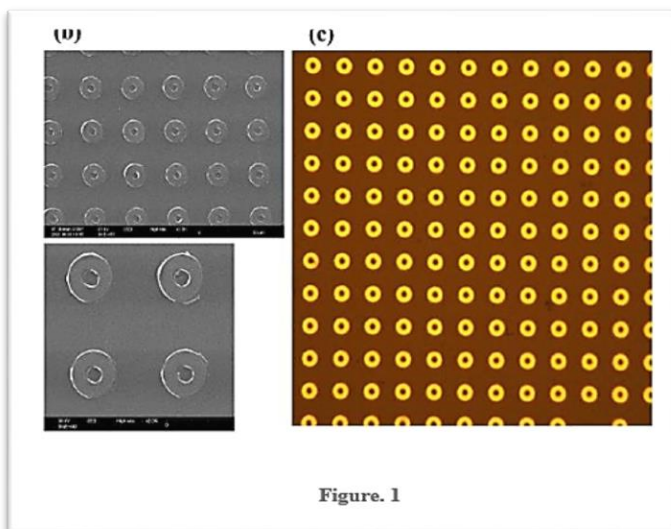
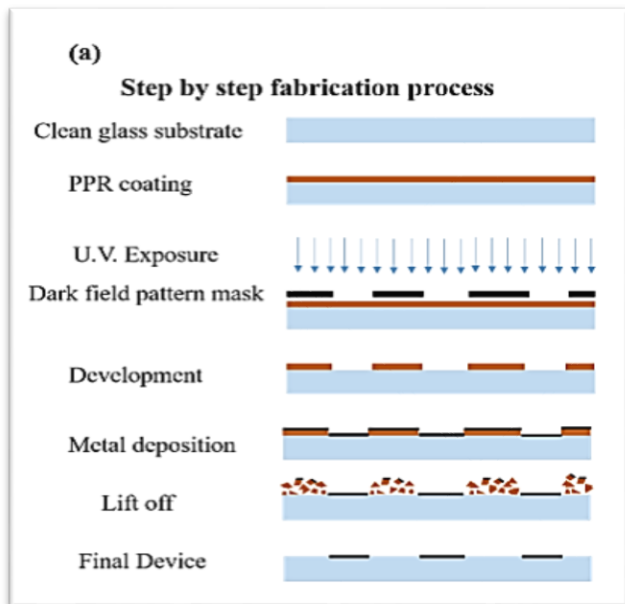


Fig. 1 (illustrate (a) schematic representation of the step-by-step process of fabricating the metal ring microstructure; (b) scanning electron microscopy (SEM) image of 10 μm micro-ring and 20 μm gap between two micro-ring; (c) Optical microscope image of micro-ring with 20 μm interspacing gap)

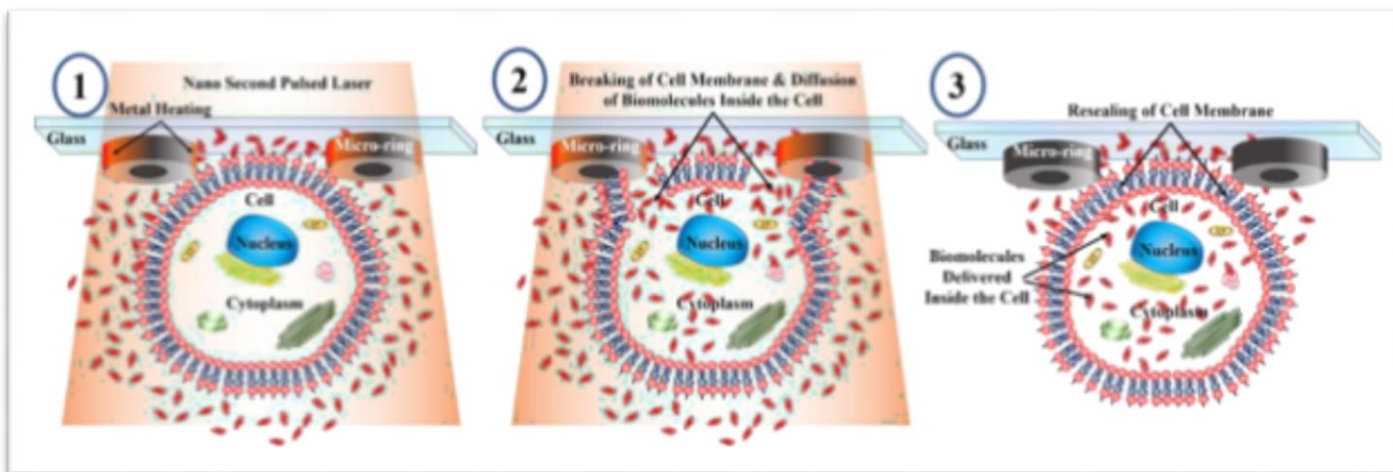


Fig. 2 (illustrate the schematic of the step-by-step working mechanism of the micro-ring intracellular delivery platform).

TRL (Technology Readiness Level)

TRL- 3/4 Proof of Concept ready & validated

Research Lab

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