

# Ultrasensitive Optical Biosensing

Keywords: Fluorescence (FL) detection, Metasurface, Biomarker

Masanobu Iwanaga

Optical Materials Field / Plasmonics Group

IWANAGA.Masanobu@nims.go.jp | <http://www.nims.go.jp/nanophoto/iwanaga/>



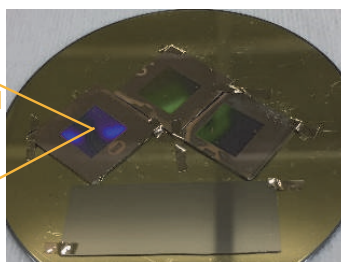
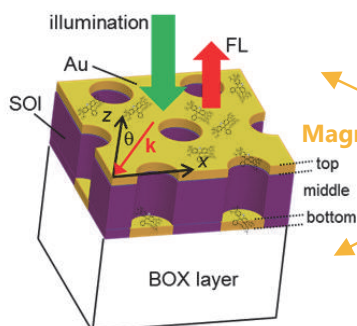
## Background

- It is widely known that FL detection is one of the sensitive sensing methods for biomolecules.
- However, highly FL-enhancing sensor substrates have been hardly reported.
- Also, it has been difficult to obtain good reproducibility in the known FL sensors.

## Aim

- Newly developing metasurfaces with high FL-enhancing capability
- Incorporating gold at the outmost surface, in order to exploit interface techniques that can select biomolecules
- Experimental demonstration of the metasurfaces

## Advanced Research Topics



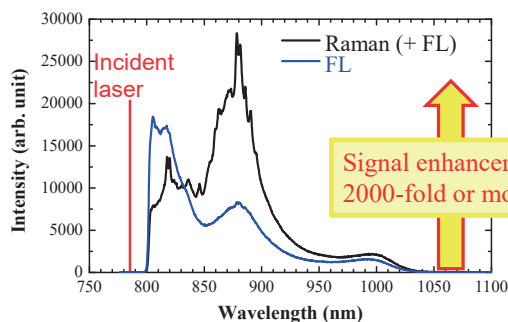
**Photo of the metasurfaces** fabricated by UV nanoimprint lithography. Large-area metasurfaces of 1 cm<sup>2</sup> were realized.

### Schematic of high-emittance metasurface

which comprises three stacked layers. The top and bottom layers are complementary in structure.

### Typical experimental results.

- ✓ Significant FL-intensity enhancement exceeding 2000 fold was obtained.



## Publications

- H. Kurosawa and M. Iwanaga, *RSC Advances* **7**, 37076-37085 (2017).
- M. Iwanaga, B. Choi, H. T. Miyazaki, and Y. Sugimoto, *Nanoscale* **8**, 11099-11107 (2016).
- M. Iwanaga, *Plasmonic Resonators: Fundamentals, Advances, and Applications* (Pan Stanford, Singapore, 2016).

## Summary

- Perfect-emittance metasurfaces were newly conceived and demonstrated.
- Mass-productive nanoimprint lithography was implemented.
- Exceptionally large FL enhancement was found.

## Research outcome

- To show many examples for FL-labeled biomolecule detection employing the metasurfaces.
- To conduct FL detection for highly interested biomarkers.