

ナノプローブを有するナノロボットの3次元光創製



NAGOYA UNIVERSITY

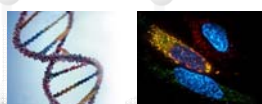
○学 早川 健, 学 深田 翔太, 正 新井史人

名古屋大学大学院工学研究科 マイクロ・ナノシステム工学専攻



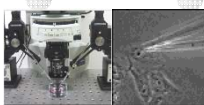
3次元ナノロボットにカーボンナノチューブを搭載し新機能を創製する!

Background



- Cell analysis
- Cell measurement
- Cell surgery

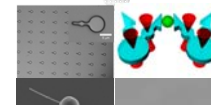
Conventional Approach



Conventional Problem

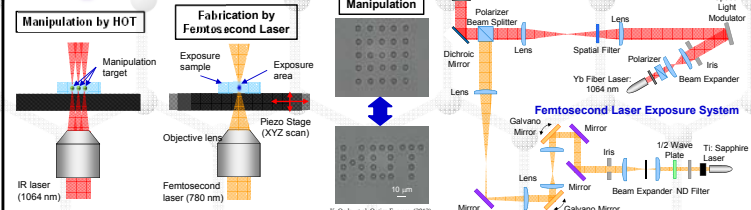
- Open space
- Low throughput
- Low repeatability
- Operator dependent

Optically Driven On-Chip Robot



- High positioning precision
- Wireless manipulation
- Multi/ independent manipulation

System

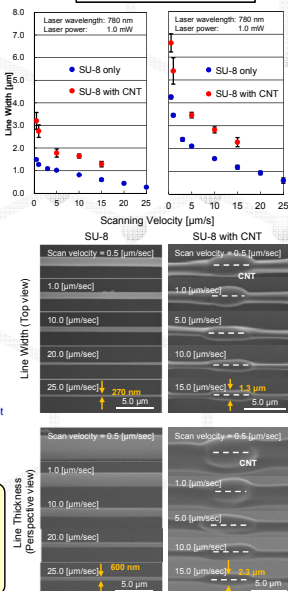


Fabrication

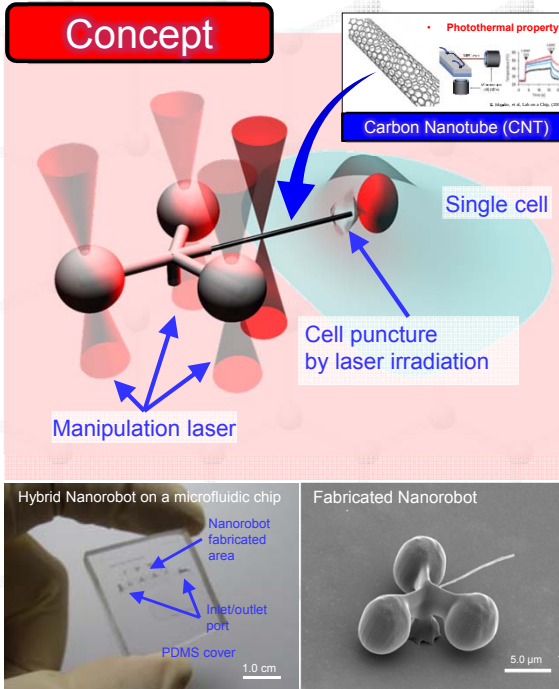
Process Flow

- Spin Coating
SU-8
Glass substrate
- CNT Coating
CNT dispersion
CNT
- Spin Coating of 2nd SU-8 layer
CNT
- Femtosecond Laser Exposure
Femtosecond laser
- Development
Hybrid nanorobot
CNT

Fabrication Resolution

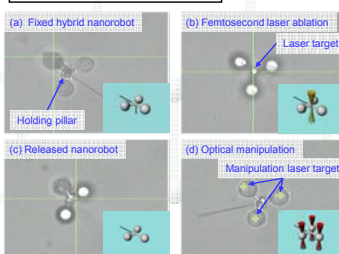


Concept

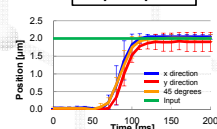


Fabrication

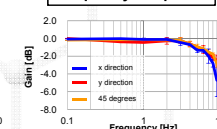
Introduction to Work Space



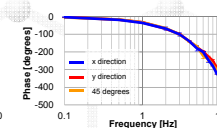
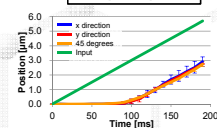
Step Response



Frequency Response

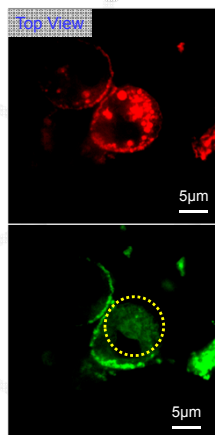
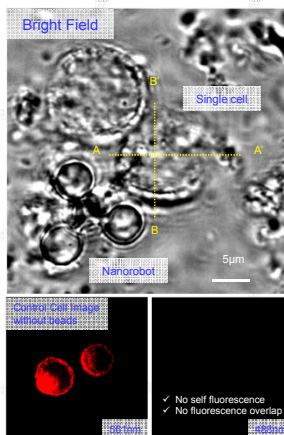
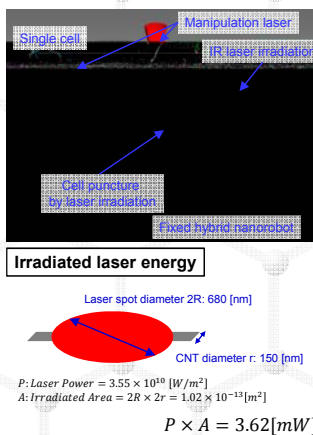
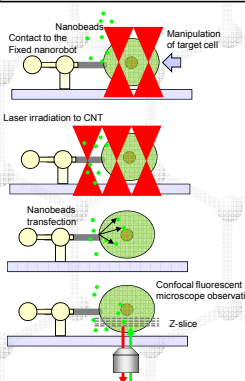


Ramp Response



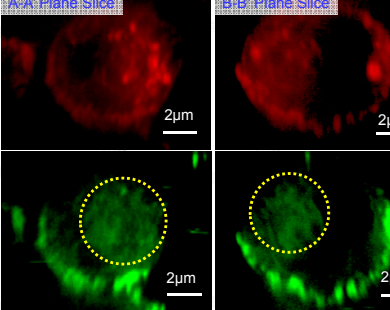
Experiment

Nanobeads injection Experiment



Cell Membrane (561nm) Nanobeads (488nm)

A-A Plane Slice B-B Plane Slice



100nm beads was injected into target cell

Conclusions

- We succeeded in fabrication of 3D hybrid nanorobot integrating carbon nanotubes (CNTs).
- We succeeded in optical manipulation of the hybrid nanorobot.
- We succeeded in single cell puncture with the hybrid nanorobot by irradiating IR laser on CNTs.

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