

EE/CprE/SE 491 WEEKLY REPORT 6 - sday18-24

10/08/17 – 10/14/17

Project title: Optical force transducer for visualizing cell mechanotransduction in 3D

Client: LIOS Lab

Advisor: Prof Meng Lu

Team Members/Role:

Quan Wang --- fabrication and process development

Yalun Tang --- fabrication and process development

Jiameng Li --- theory and numerical modeling

Qinming Zhang --- theory and numerical modeling

o Past week accomplishments

- Yalun Tang:
 1. Used the microscope to observe the bare optical fiber.
 2. Installed an FC connector on a one-meter long single mode optical fiber.
 3. Coupled the single mode optical fiber with laser.
 4. Found a new way to stabilize the fiber in surface chemistry using magnets
 - a. Hang the fiber on the fiber stand, and use magnets to settle the fiber on the fiber stand, so the 2 inches of the fiber tip is directly dipped into the solution

- Quan Wang:
 1. Installed the FC connector: each connector can only attach to one fiber
 2. Started a new surface chemistry with the new fiber(prepared 1 meter long single mode optical fiber, only 2 inches of the fiber tips will be used in surface chemistry)
 - a. Only stripped off the coating layer, the cladding layer was hard to be removed unless etched by certain solution
 3. Coupled the fiber connector with the laser, and observed the connected laser beam in the tip of the fiber under the fluorescence microscope
 - a. The beam can be seen, but the gold nanoparticles are not reflected, the dimension of the gold nanoparticles are too small to observe in fluorescence microscope

- Jiameng Li:
 1. Finish building model in 2D version. Try to arrange metal ball in different location to see waving difference
 2. Do research for preparing 3D version.

- Qinming Zhang:
 1. Research about the 3-dimensional model of optical fiber
 2. Refine the parameters in the 2-dimensional model

- Group:
 1. Installed the FC connector onto the optical fiber
 - a. 1 meter single mode optical fiber
 - b. Cleaned and polished by following the manual
 2. Finished the second trail of surface chemistry
 - a. Using the FC connector installed 1 meter single mode optical fiber
 - b. 2 inches of fiber tip attached to the gold nanoparticles
 3. Coupled the fiber connector with the laser
 4. Research the manual to start the 3D numerical model
 - a. How to turn 2D model into 3D model

o **Pending issues**

1. We thought the cladding was made of plastics before. But we failed to use heater to remove the coating. Therefore, the cladding is not made of plastics. After calling the company where we bought the fiber, we figured out that the cladding is made of doped silica.
2. We have tried to do the surface chemistry without removing the cladding layer, but failed at the end because it cracked into two parts when observing under microscope
3. We will try to find a new method like HF etching to remove the cladding layer

o **Individual contributions**

| Team member | Contribution | Weekly hours | Total hours |
|---------------|--|--------------|-------------|
| Yalun Tang | Installed an FC connector on fiber; coupled the fiber with laser. | 6 | 35 |
| Quan Wang | Finished second trail of surface chemistry; coupled the fiber with laser | 6 | 35 |
| Jiameng Li | Research for transfer 2D version into 3D version. Change different parameter, and compare results. | 6 | 35 |
| Qinming Zhang | Prepare to changed 2D version to 3D version. Tried to make the result more accurate and precise. | 5 | 34 |

o **Plan for coming week**

- Yalun Tang and Quan Wang(fabrication):
 1. To remove the coating from the end of the one-meter fiber which we installed an connector
 2. To finish the surface chemistry for that fiber then attach the gold nanoparticles.
 3. To couple that fiber with laser then observe the bare part under the microscope.

- Jiameng Li and Qingming Zhang(simulation and modeling):
 1. We are going to make the 3D version of optical force based transducer.

O Summary of weekly advisor meeting

In the meeting, we discussed the new approach to remove the cladding layer which is to etch the layer using HF acid. Professor Lu suggest that we should ask the MRC to find out if they have the solution we need, and we would need permission to enter the MRC. Meanwhile, we need to design the new process to etch the cladding layer, and find the best concentration of the HF. Beside the fabrication part, we meet some challenges on the simulation and modeling of optical force transducer by changing the 2D model to 3D model.