EE/CprE/SE 492 Bi-WEEKLY REPORT 3 - sdmay18-24

02/12/18 – 02/23/18

Project title: Optical Wash-free Transducer for Biomarkers analysis
Client: LIOS Lab
Advisor: **Prof Meng Lu**

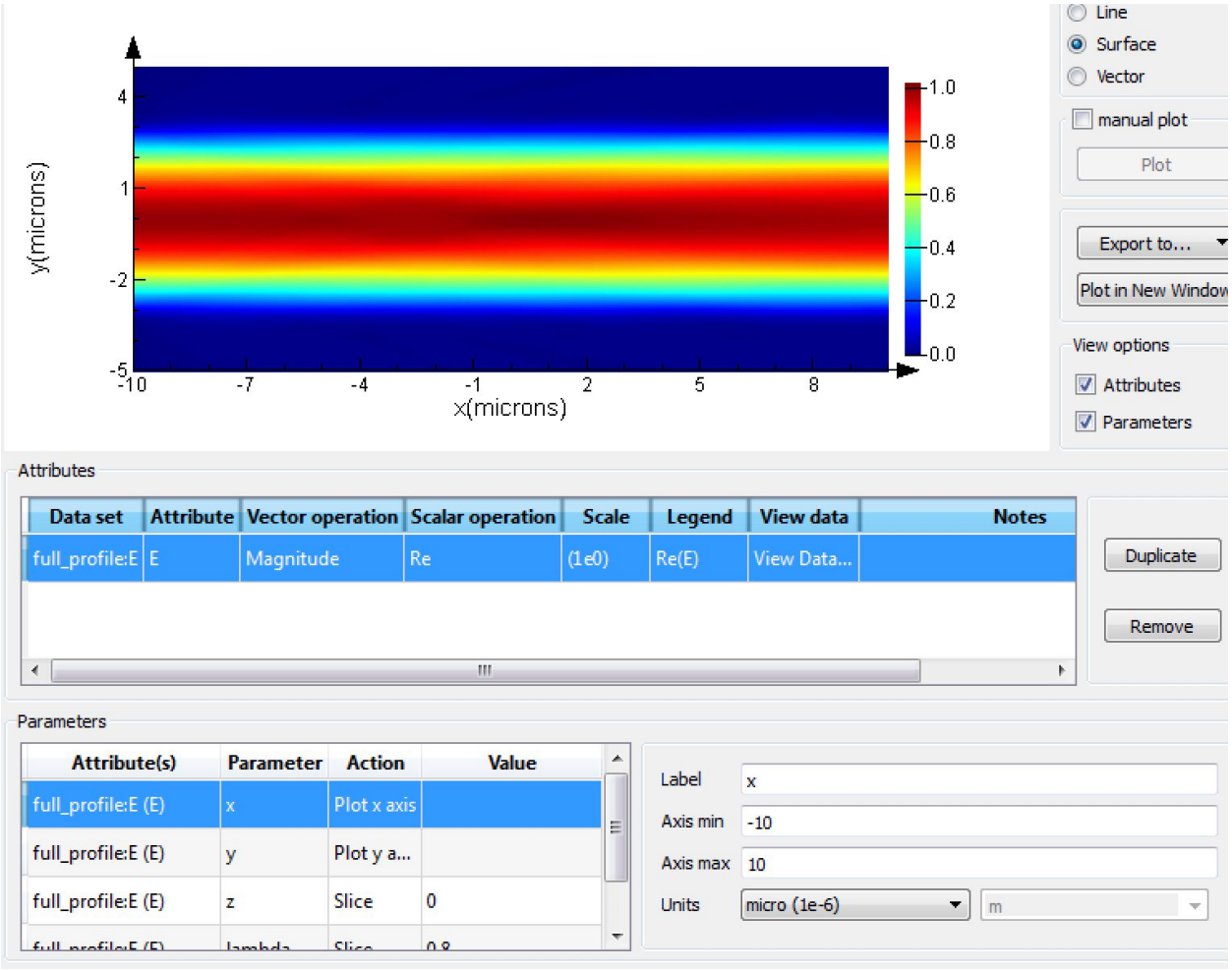
Team Members/Role:
Quan Wang --- fabrication and process development
Yalun Tang --- fabrication and process development
Jiameng Li --- theory and numerical modeling
Qinming Zhang --- theory and numerical modeling

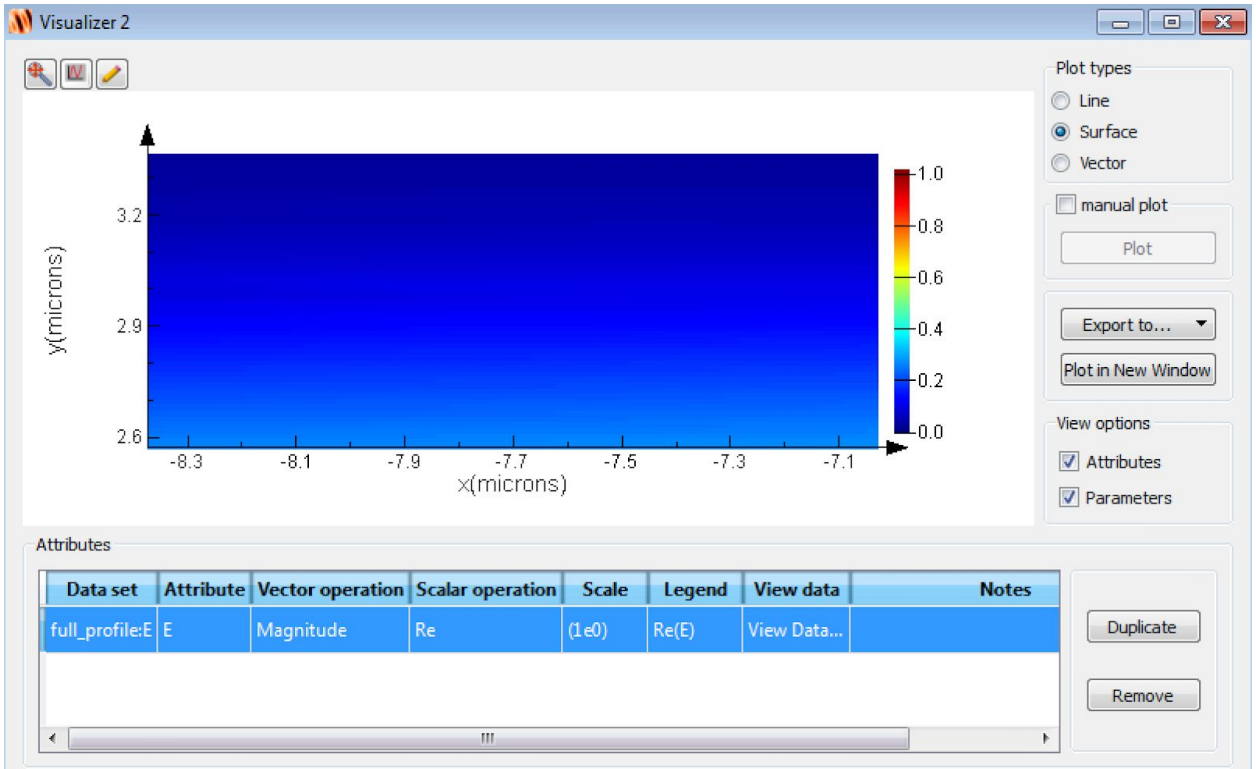
- **Past 2 weeks accomplishments**

- Yalun Tang:
1. Used an objective lense to improve the efficiency of coupling between fiber and laser.
2. Performed HF wet etching to etch the optical fiber.

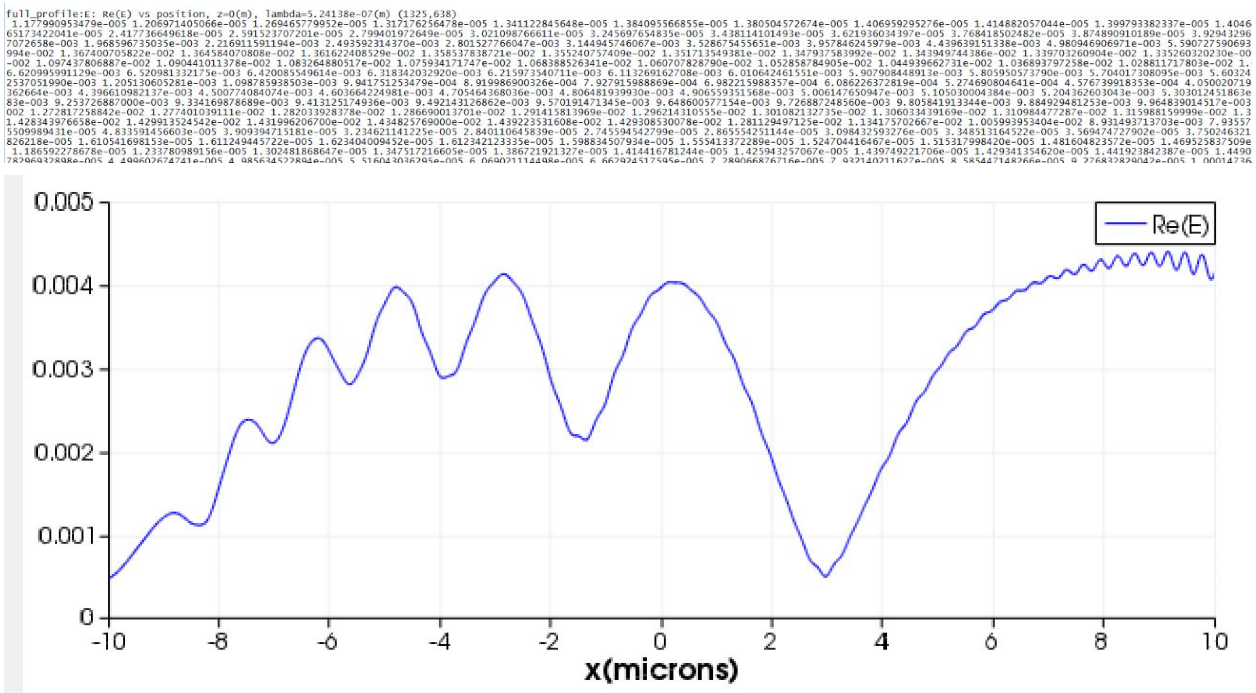
- Quan Wang:
1. Performed HF wet etching 5 times to minimize the cladding layer of optical fiber
2. Observed the fiber under the fluorescence microscope
    a. Measure the fiber diameter

- Jiameng Li:
1. In this two weeks, I changed diameter of the fiber from 8 micrometers to 6 micrometers, so the field distribution looks like the following figures. Around surface of the fiber, there's slightly scattering light appears.


y(microns)
x(microns)
4
1
-2
-5
-10
-7
-4
-1
2
5
8
1.0
0.8
0.6
0.4
0.2
0.0
Line
Surface
Vector
manual plot
Plot
Export to...
Plot in New Window
View options
Attributes
Parameters
Attributes
Data set
Attribute
Vector operation
Scalar operation
Scale
Legend
View data
Notes
full_profile:E
E
Magnitude
Re
(1e0)
Re(E)
View Data...
Duplicate
Remove
Parameters
Attribute(s)
Parameter
Action
Value
full_profile:E (E)
x
Plot x axis
full_profile:E (E)
y
Plot y a...
full_profile:E (E)
z
Slice
0
Label
x
Axis min
-10
Axis max
10
Units
micro (1e-6)
m



2. In order to see the light intensity, I export all data into text from, and import these data into Matlab.



- Qinming Zhang:

1. Adjust the position of the hole for fiber in the etching platform. The previous hole is too far away to be detected by the microscope. So I drill another hole above the previous hole. To make sure the fiber can be detected, the position of the fiber must locate 1mm under the lens of the microscope. Now the fiber is in focus under the microscope.

o **Pending issues**

1. **We need to etch the fiber to have around 1 micrometer diameter. Therefore, we need to perform multiple times of etching and measurements. However, there is something wrong with the hand switch of the microscope in the lab. We can't switch to use the 20X objective. We need to wait until the hand switch is fixed.**

o **Individual contributions**

Team member	Contribution	bi-Weekly hours	Total hours
Yalun Tang	Improved the coupling efficiency and performed wet etching.	10	30
Quan Wang	Use HF etching to clear the cladding layer	20	30
Jiameng Li	Find scattering intensity for the fiber at diameter of 6 micrometers.	10	30
Qinming Zhang	Made the glass slide with holes. Improved the etching platform.	10	30

o **Plan for coming weeks**

- Yalun Tang and Quan Wang(fabrication):

1. To measure the diameter of etched fibers to figure out the required etching time to get 1 micrometer diameter.
2. To prepare another single mode optical fiber with the connector. And to immobilize it on the new designed holder to perform the wet etching. Finally, we will conduct surface chemistry to observe the light scattering by gold nanoparticles.

- Jiameng Li and Qinming Zhang(simulation and modeling):

1. Next week we will work on continuing change diameter of the fiber to 4 micrometers, with the same step, we will see the field distribution, scattering light intensity, until we find the closest diameter to our expectation.
2. If storage is enough for 4 micrometers, we will change the model from 2D to 3D, so that the data we accumulate may becomes more accurate.

Summary:
In these two weeks, we improved our fiber holder, performed HF etching by using new method, and used simulation to improve the waveguide. We still face some problem in the process of etching because the fiber is very hard to control, however, we have developed a better model for our numerical simulation part which will speed up our experiment at next stage.