# Investigation of Cold Atmospheric Plasma induce Apoptosis in Cancer Cell

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# Outline

1. Introduction
2. Research Objectives
3. Theory
4. Experimental details
5. Result and discussion
6. Conclusion

# Research Objectives

To develop the cold atmospheric pressure plasma sources as the tool to induce apoptosis in cancer cell.

# Introduction

## Cancer incidence in Thailand

1


Liver

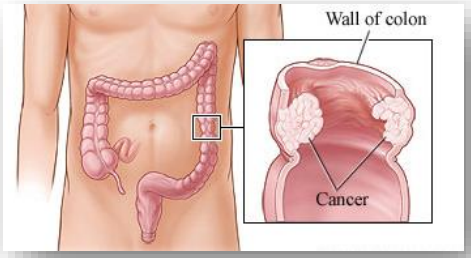
41.7%

2


Lung

27%

3




Colon and rectum

13.1%

# Introduction

## Treatment

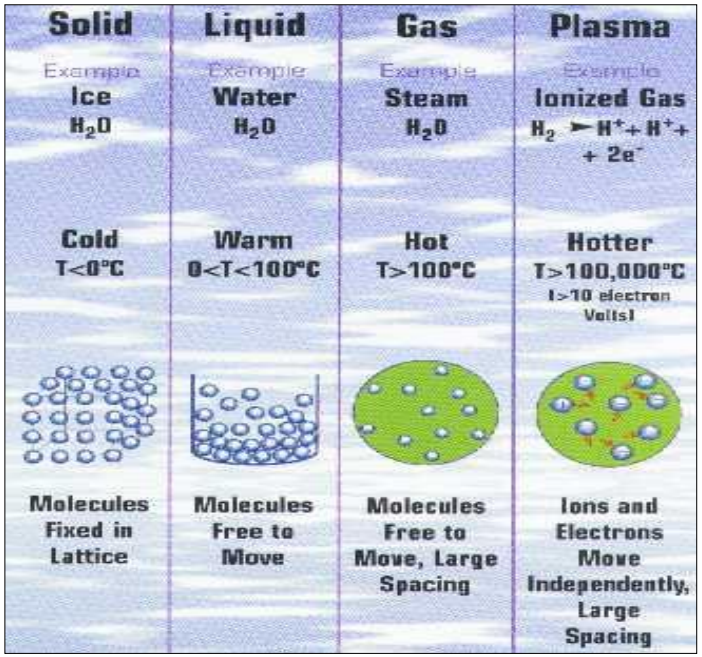

some drawback

**Cold Plasma**

selective killing

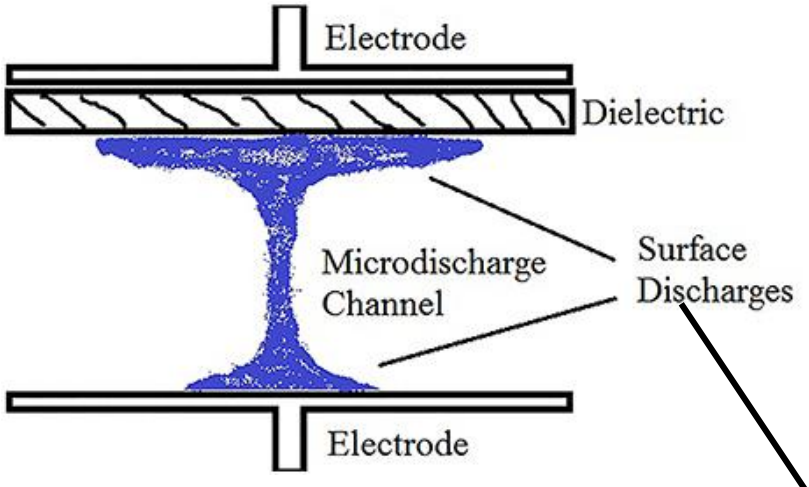
# Plasma

Plasma is an ionized gas consisting of positive/negative charges, radicals, neural atoms and ultraviolet (UV) photons, that is, a gaseous matter with quasi–neutral charges



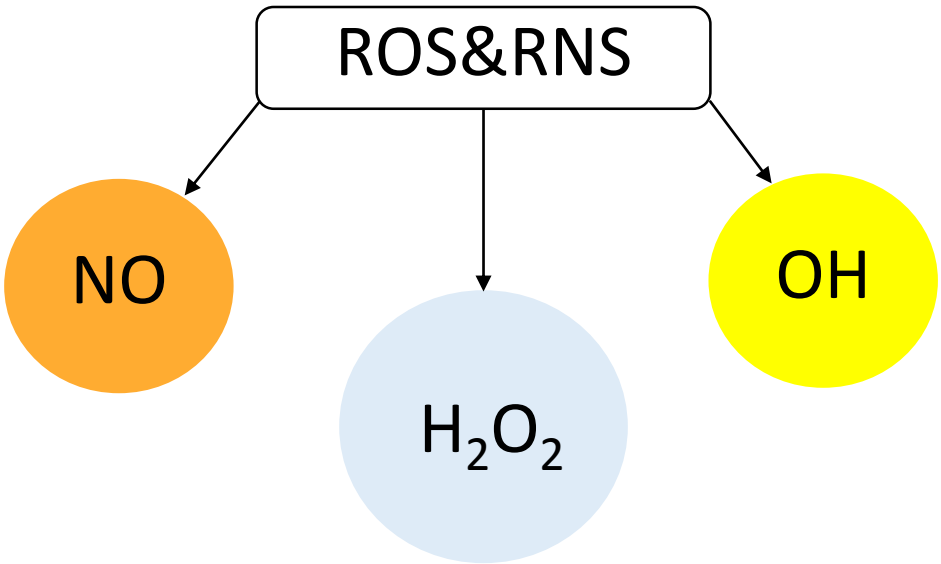

Cold Plasma

# Dielectric–barrier discharge (DBD)




Dielectric–barrier discharge (DBD) is the electrical discharge between two electrodes separated by an insulating dielectric barrier

1. damage of DNA or RNA
2. oxidations of polyunsaturated fatty acids in lipids (lipid peroxidation)
3. oxidations of amino acids in proteins
4. oxidative deactivation of specific enzymes by oxidation of co-factors

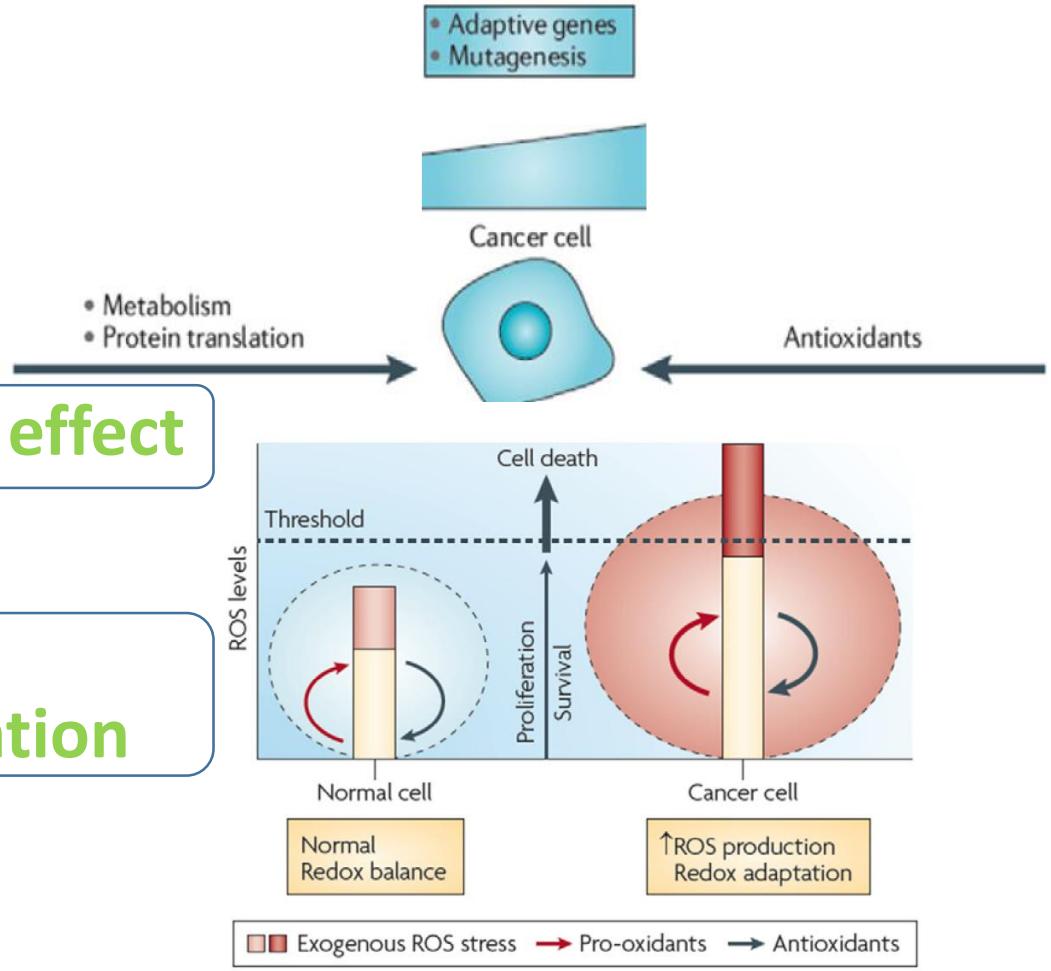


# Molecular mechanisms of the cold atmospheric plasma–based anti–cancer treatment

ROS

Beneficial effect

cell proliferation

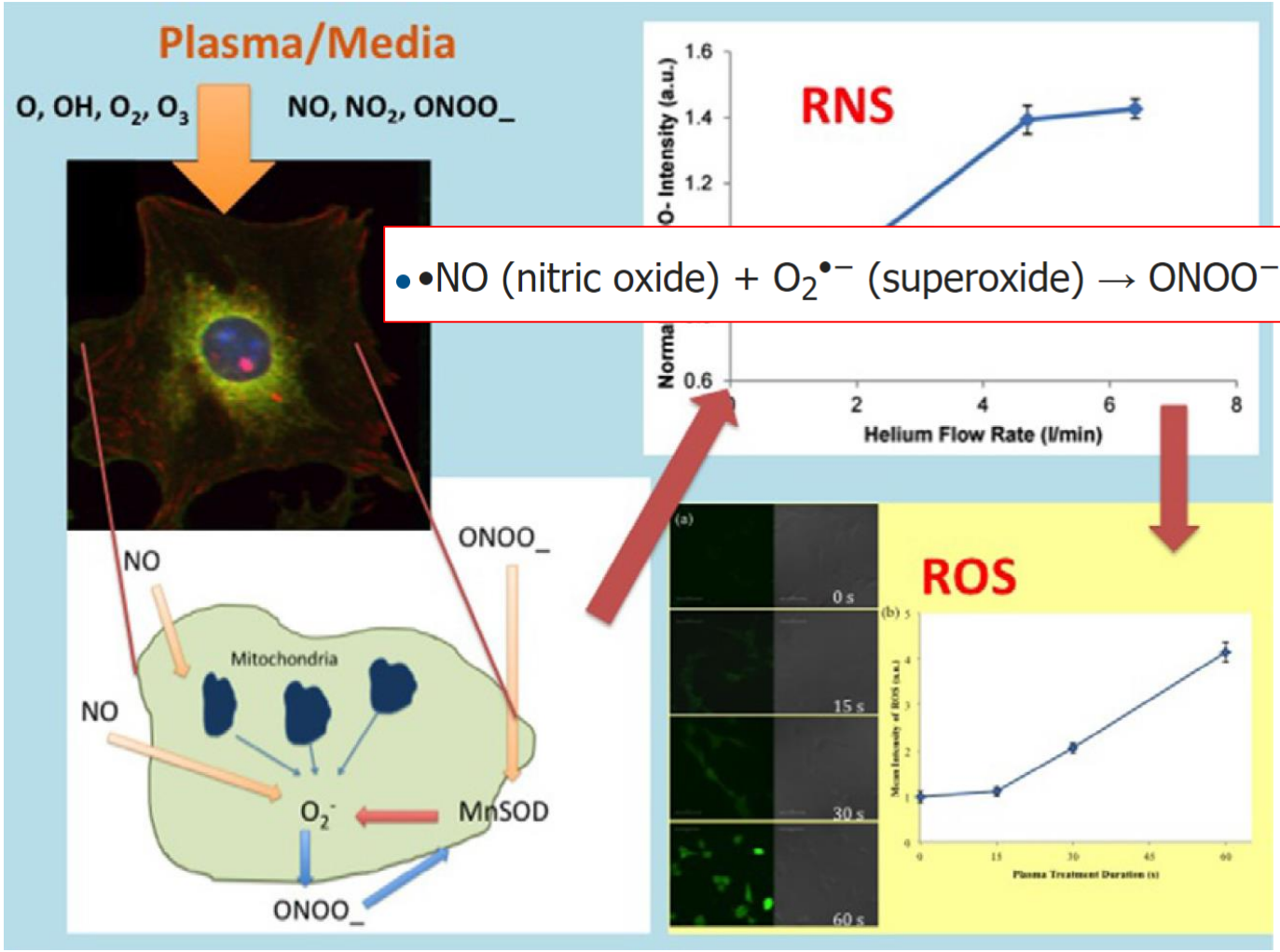



ROS

apoptosis

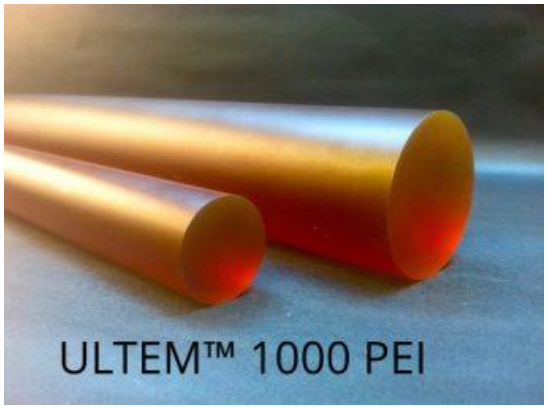
Anti-Cancer

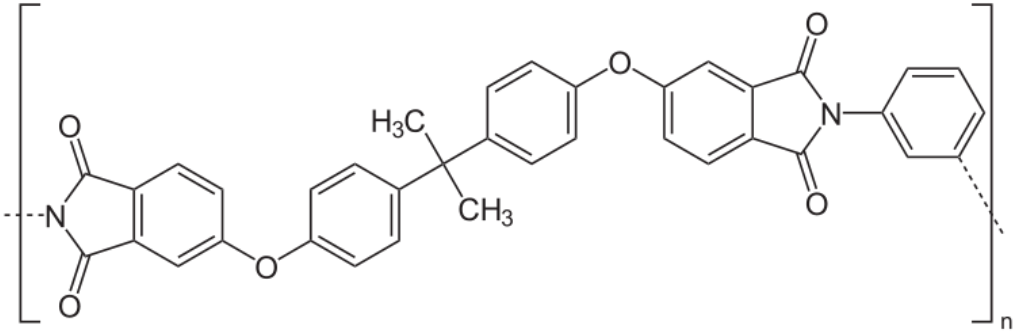
# Schematics of CAP interaction with cells




• •NO (nitric oxide) + $O_2^{\bullet -}$ (superoxide) → $ONOO^-$ (peroxynitrite)

# Polyetherimide (Ultem1000)

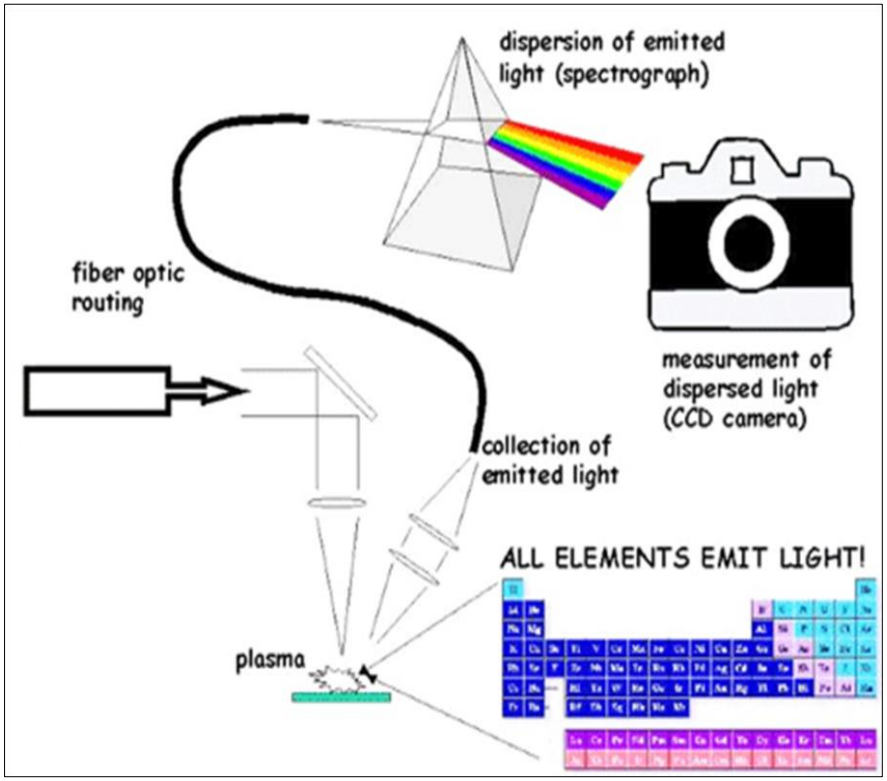



Polyetherimide PEI is an amorphous, amber–to–transparent thermoplastic with chemical formula of $(C_{37}H_{24}O_6N_2)_n$

- Toughness, stiffness ,chemical resistance and Non–Toxic

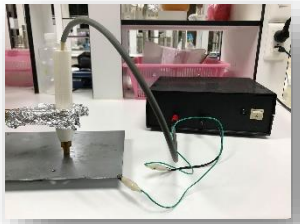
# Optical emission spectroscopy(OES)




- It can measure electromagnetic wave spectral range of 100 – 900 nm
- used for plasma diagnostics are in principle similar as UV–VIS spectrometers used in chemistry.

# Experimental Plan

Develop mini-DBD



Investigation of physical properties

Power measurement

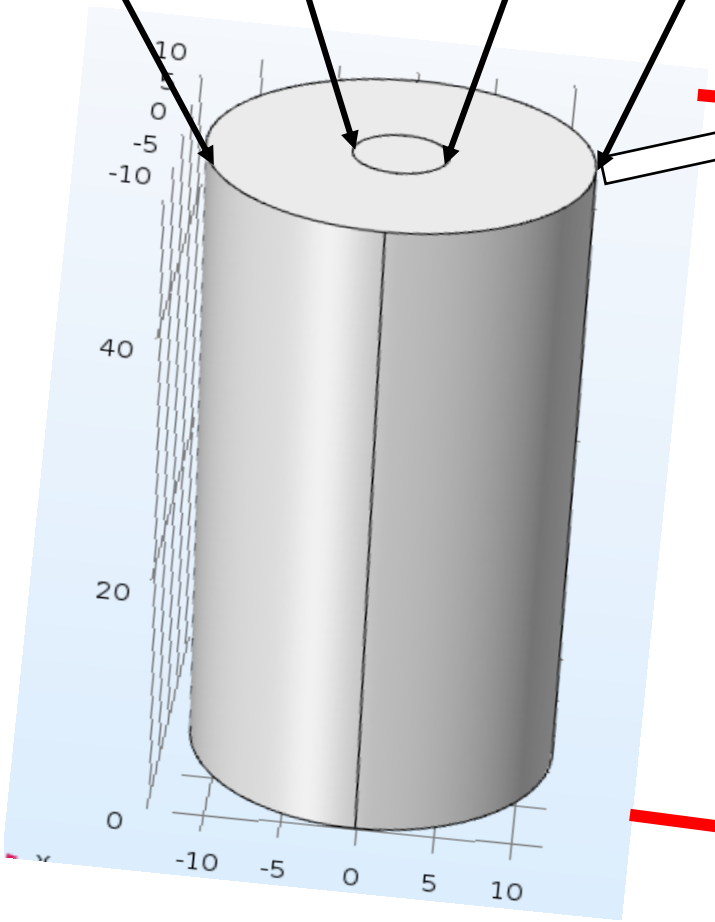
Optical emission spectra measurement

# Develop of mini-DBD

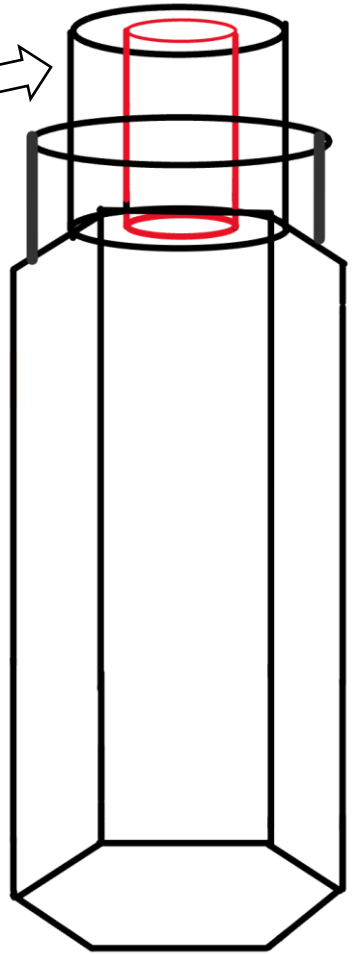
Diameter (out) = 9mm (Dielectric)

Diameter (in) = 3 mm(Electrode)

| | |
|---|---|
| Dielectric | Ultem 1000 |
| Electrode | Aluminium |

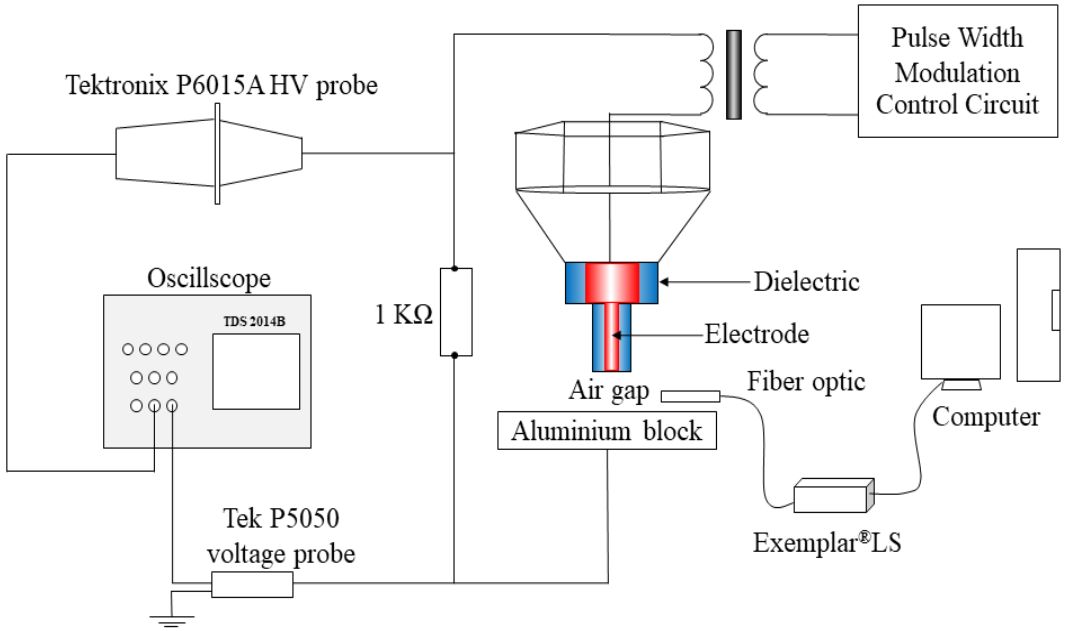


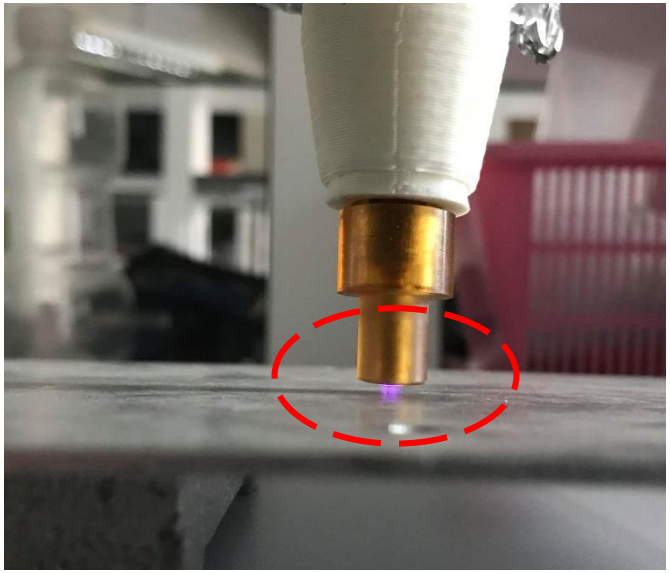

30 mm



# Investigation of physical properties

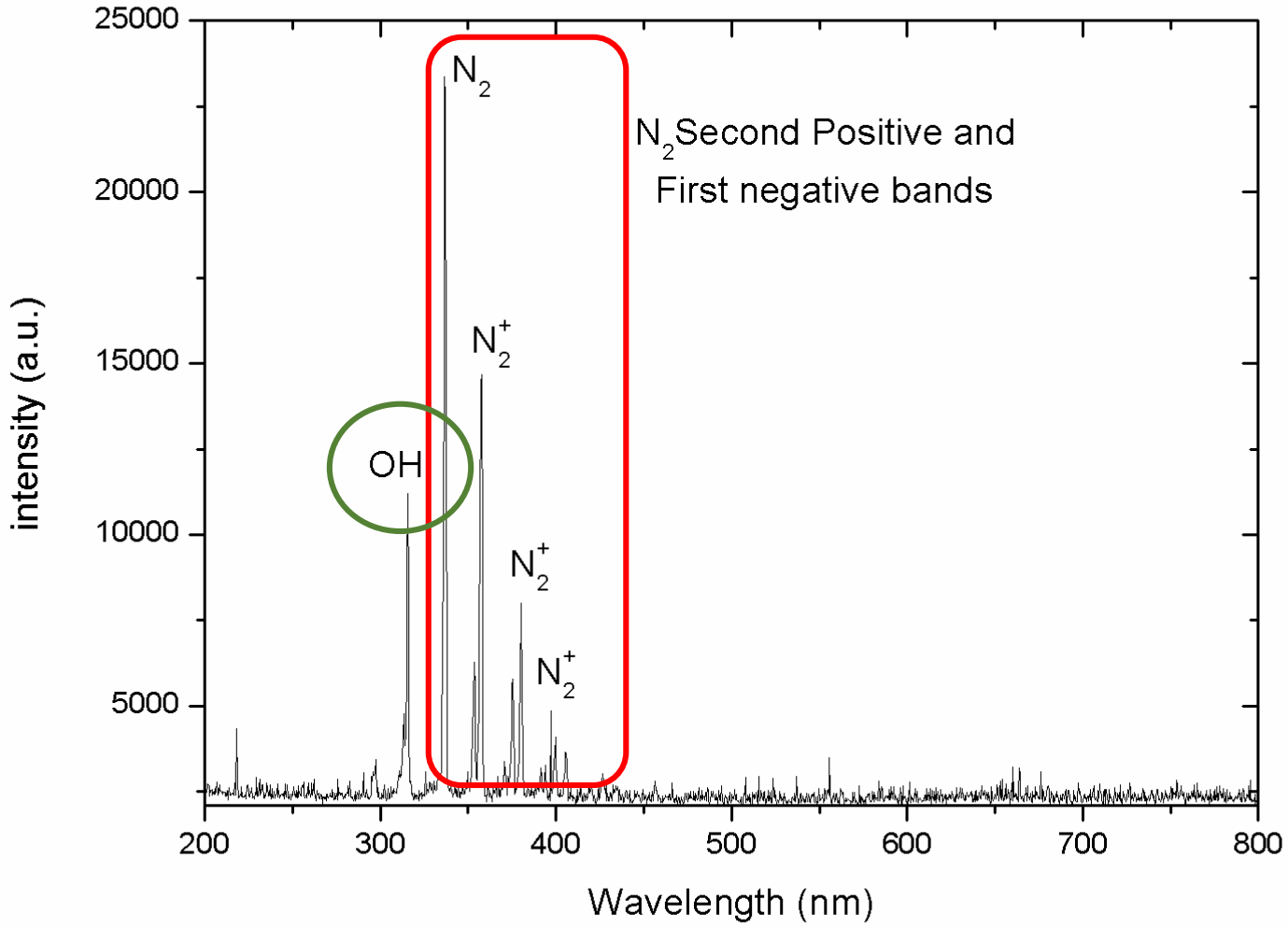
- Set up of power characteristic and optical emission spectra measurement



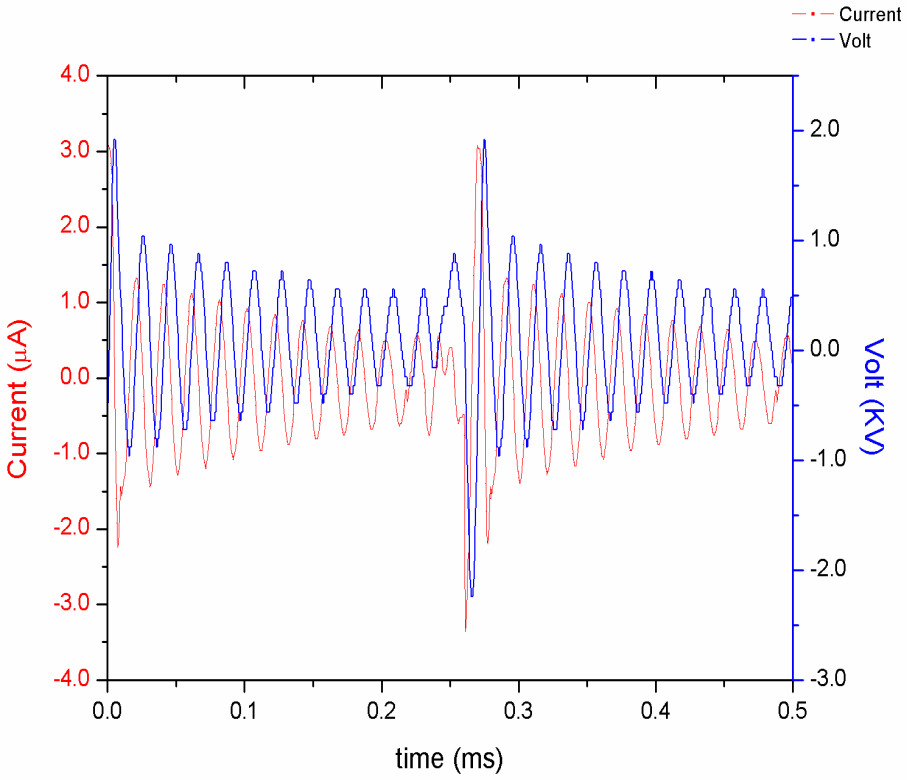



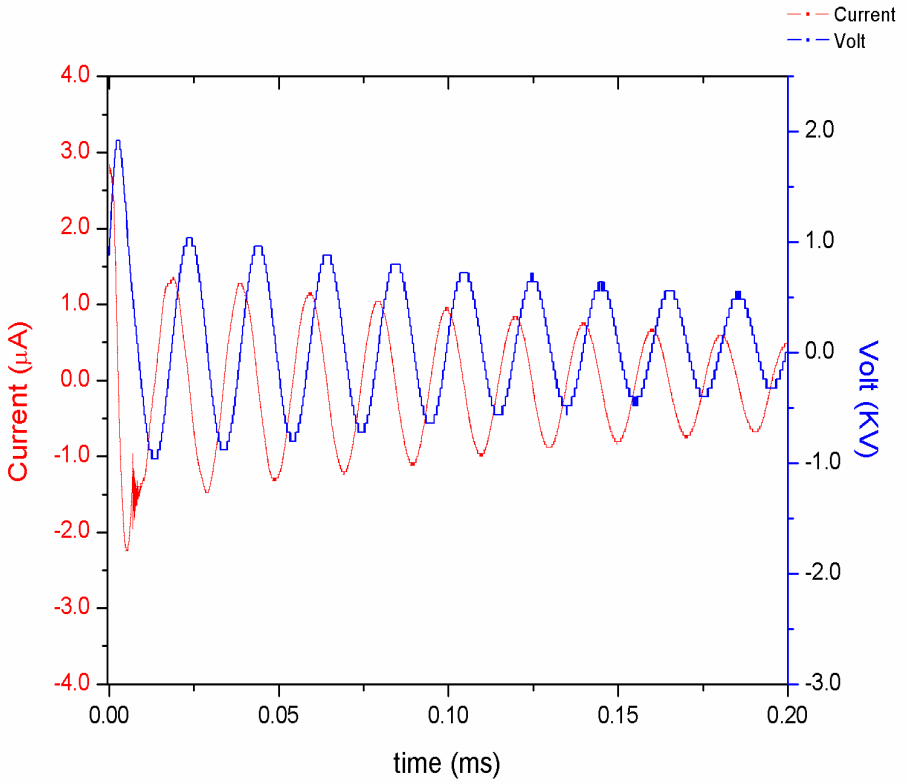
# OES measurements of plasma

the spectrum of plasma



# Plasma power characteristic




$$P = \frac{1}{T}\int_0^T v(t)i(t)dt$$

# Conclusion

- The optical emission spectra show dominant $N_2$ band and OH band.

- The electrical properties of the developed mini–DBD plasma approximately 0.3 W.

# Thank you for your kind attention