



# Probe measurement of an ECR hydrogen plasma facing the C12A7 electrified surface

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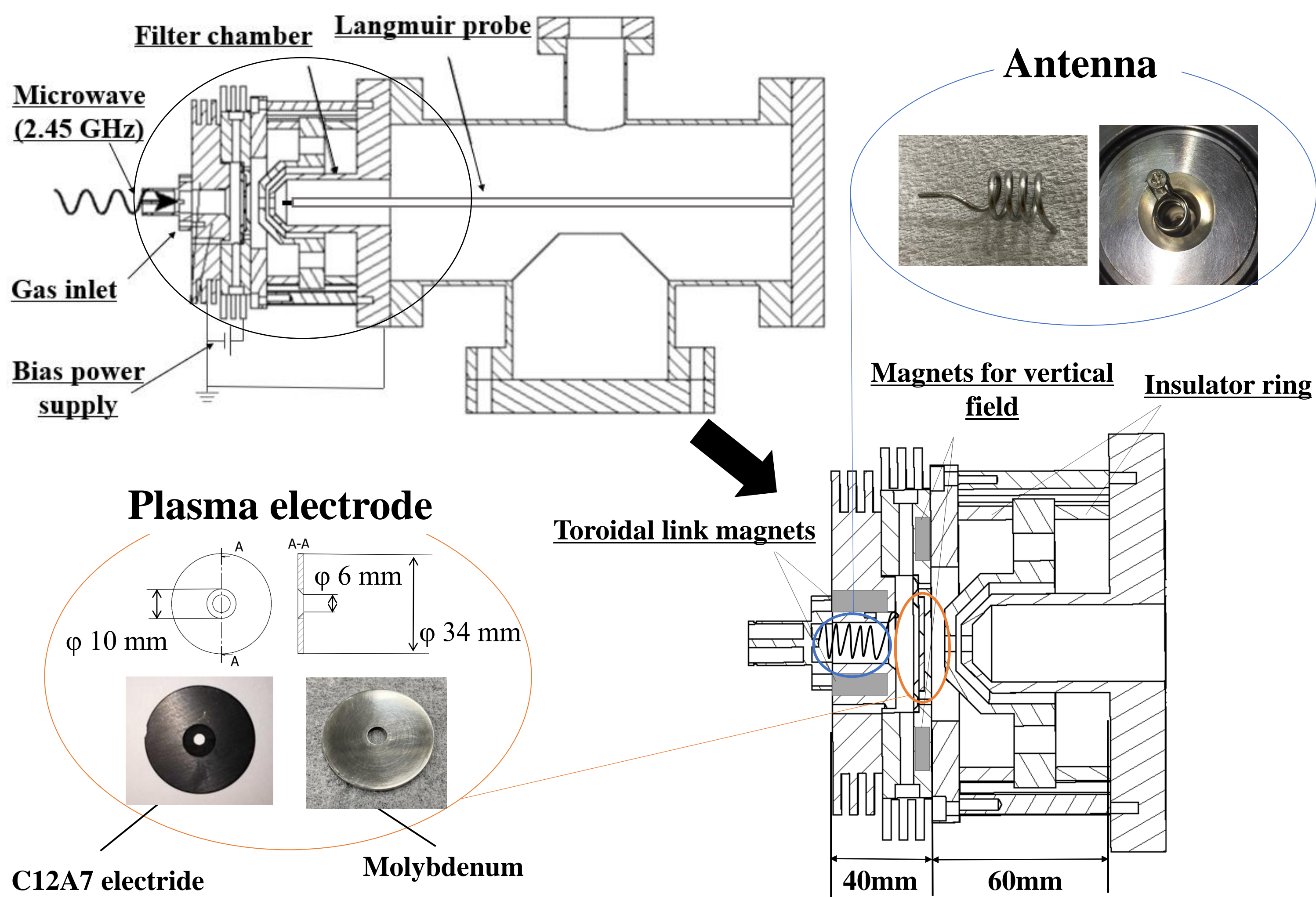
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## INTRODUCTION

Plasma parameters of an ECR (electron cyclotron resonance) discharge excited in a compact (5 cm diameter, 3.3 cm long inner volume) ion source with the replaceable plasma electrode (PE) were measured with a Langmuir probe. A plasma electrode (PE) made of a C12A7 “electrified” constituted with 12CaO and 7Al<sub>2</sub>O<sub>3</sub> supplied by AGC Inc., was installed to investigate how the electrified PE changes the plasma parameters from those with Mo PE. The effect upon the plasma parameters in front of the PE due to the material will be elucidated by changing the probe position radially from the ion source center axis above the extraction hole to the periphery, and axially along the beam extraction direction.

## EXPERIMENTAL SETUP

### A schematic diagram of the experimental setup

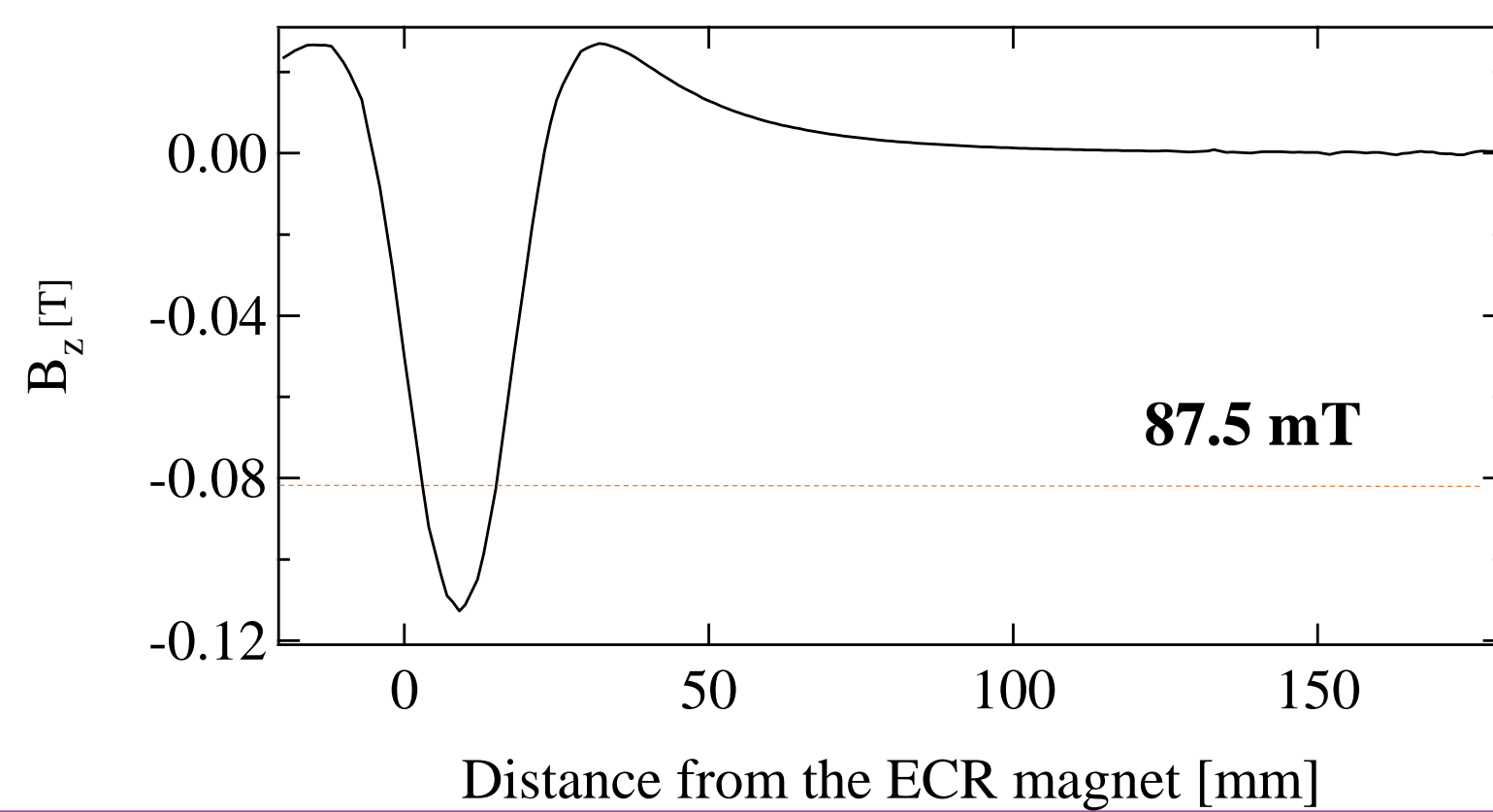


#### Ion source design

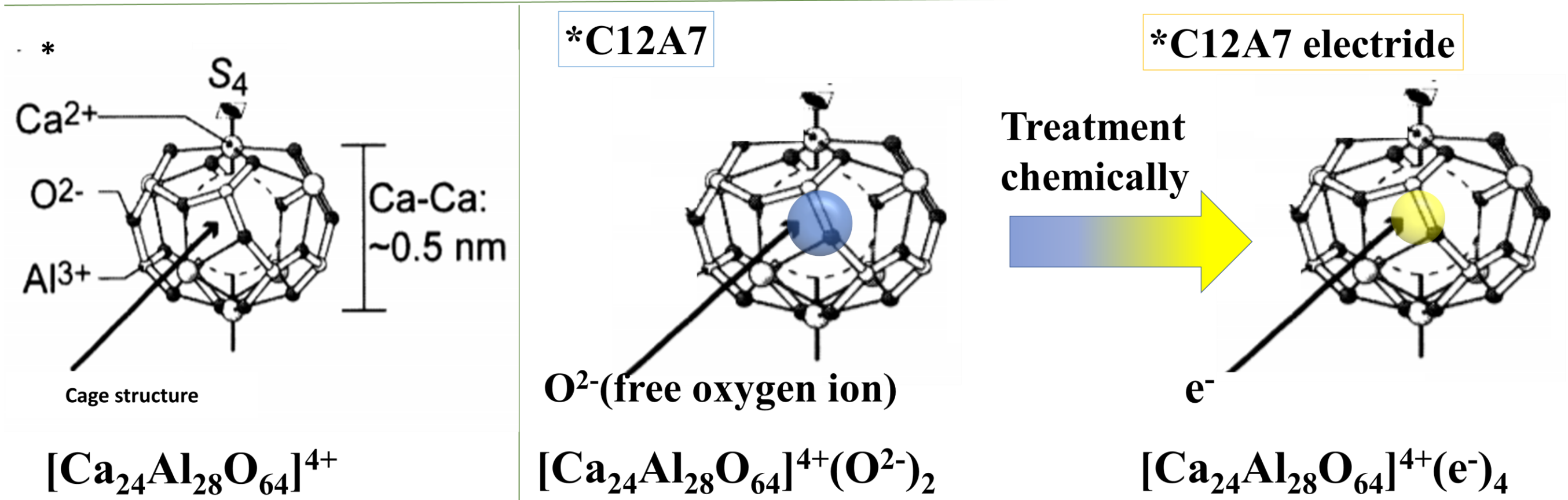
- ECR discharge with toroidal link magnet field (2.45 GHz cylindrical space(φ9.5 mm) microwave and 87.5 mT)
- Spiral Antenna in 15 mm diameter
- 39mm distance from feedthrough to PE

#### Plasma electrode (PE)

- 34mm diameter
- 6mm hole diameter
- Materials : C12A7 electrified and Mo



## C12A7 electrified

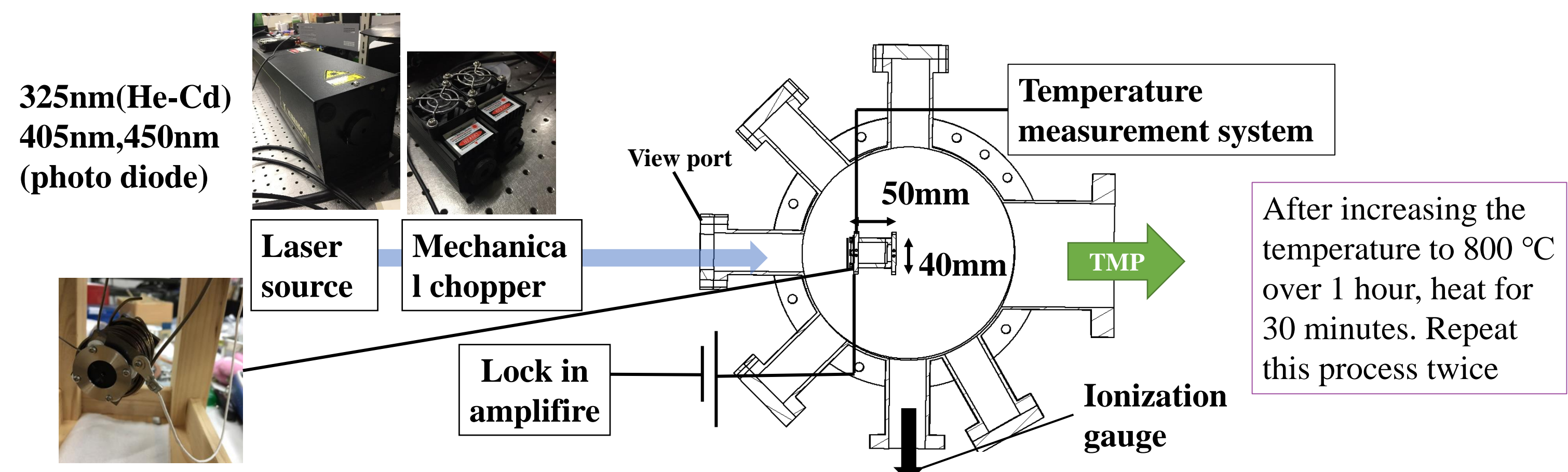


- Cage structure
- Ceramic (C12A7)
- Clathrate negative ion (O<sup>2-</sup>)

- Replacement free oxygen ion by reduction to electron results in C12A7 electrified
- High electric conductivity
- Low work function (2.4eV)<sub>[2]</sub>
- Chemical stability and high heat resistance

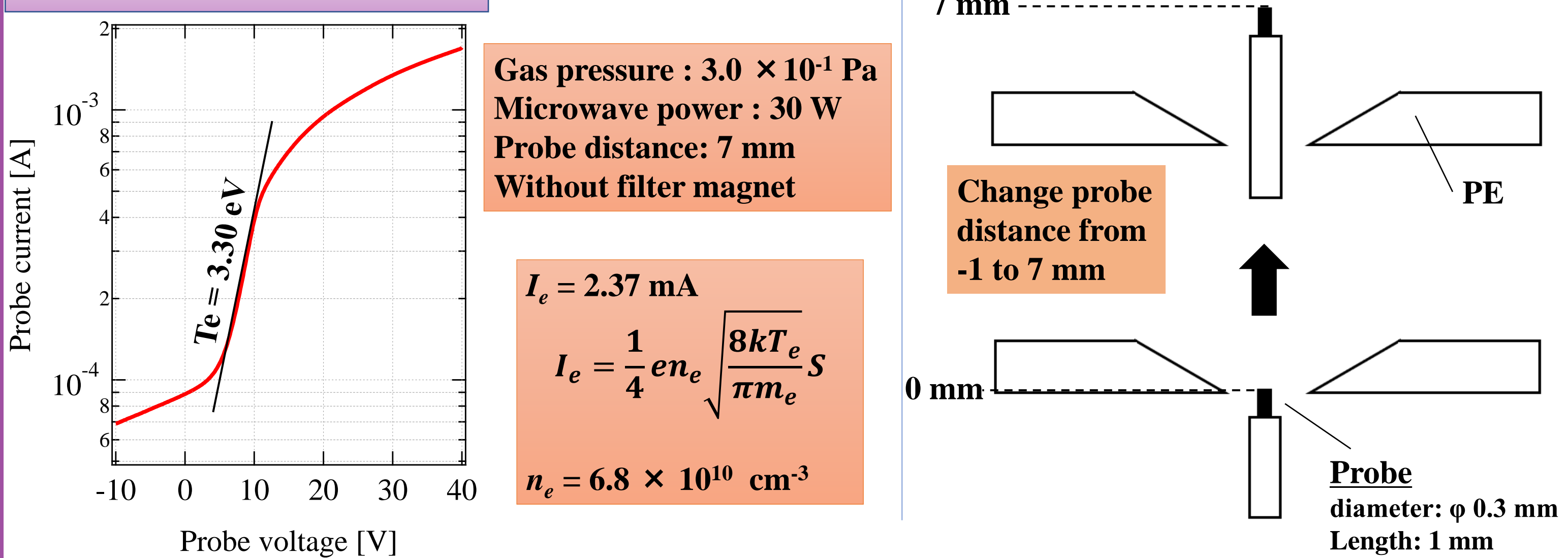
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The crystallographic society of Japan 49 171-178: fig1

### Pretreatment system for electrified

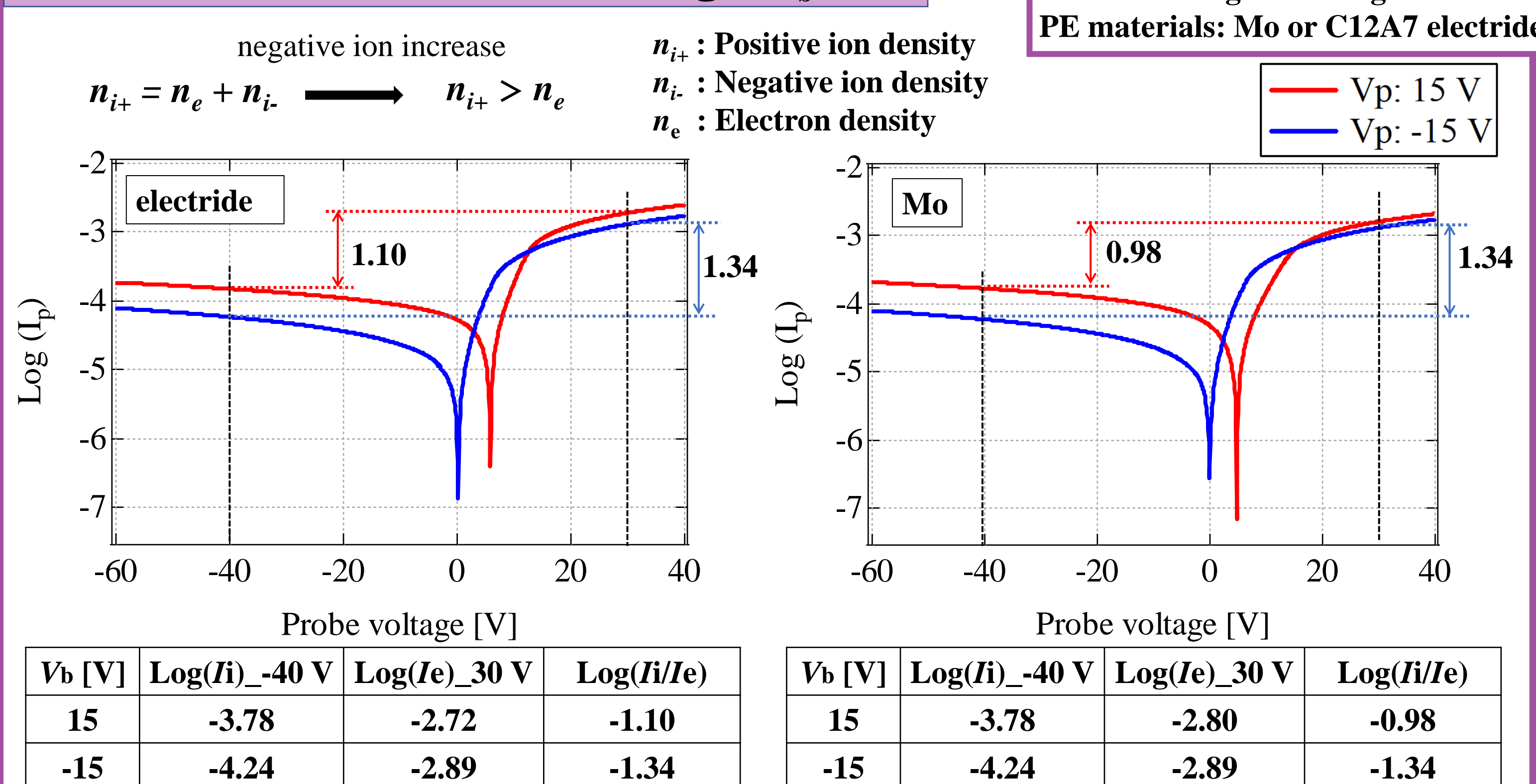


## RESULTS

### Probe measurement



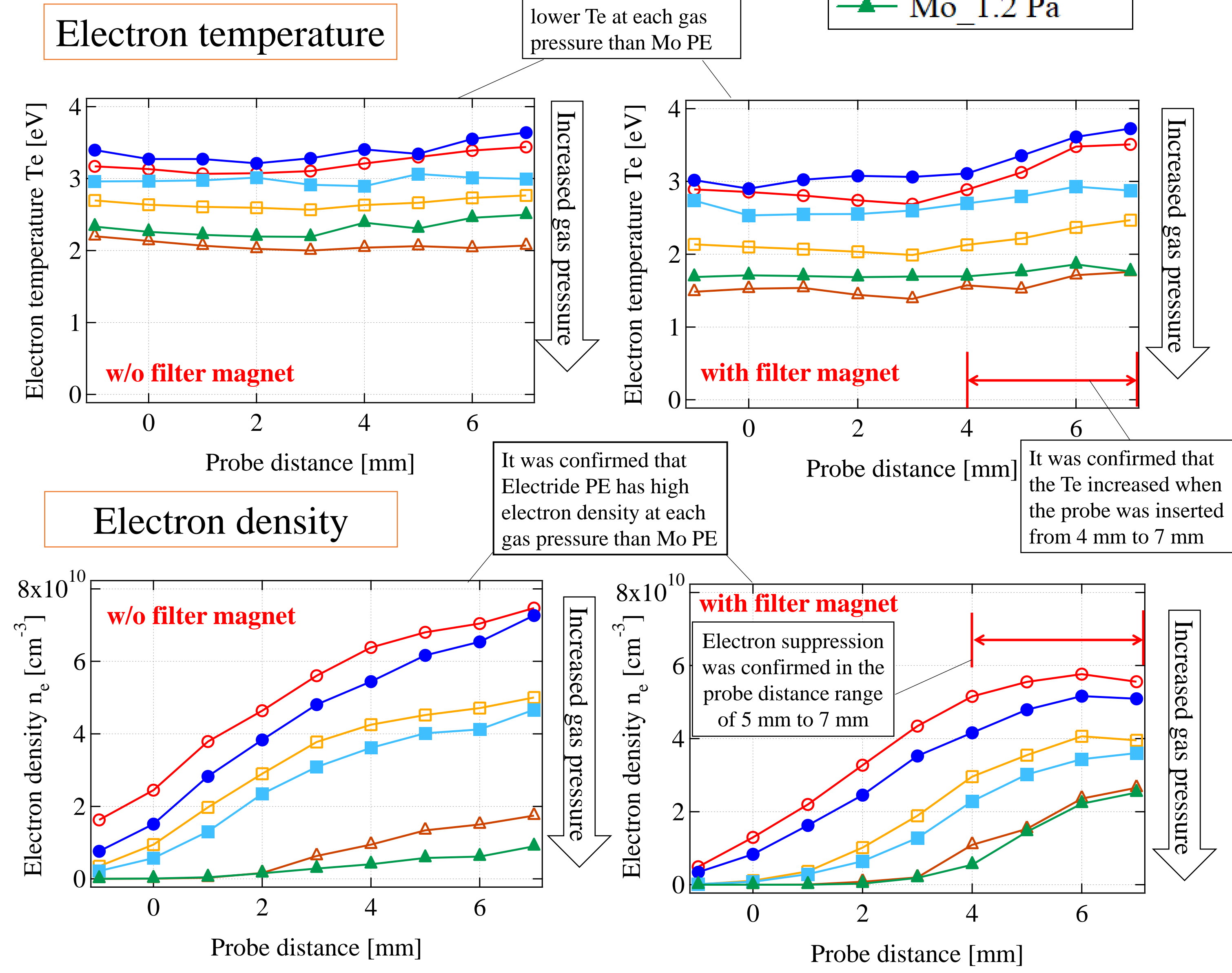
### Influence of PE Bias Voltage (V<sub>b</sub>)



### Plasma characteristics

#### Experimental Condition

Input Power (Micro wave) : 30 W  
PE Bias Voltage : floating  
PE materials: Mo or C12A7 electrified



## SUMMARY

- ◆ As V<sub>b</sub> was varied from 15 to -15 V no significant change in I<sub>i</sub>/I<sub>e</sub> was observed between the molybdenum PE and the electrified PE.
- ◆ Inserting a filter magnet reduced the Te by about 10 % under condition of the probe distance of -1 to 4 mm. On the other hand, inserting a filter magnet suppressed low-energy electrons at probe distance from 5 to 7 mm, decreasing n<sub>e</sub>.
- ◆ It was confirmed that electrified PE has a lower Te and a higher n<sub>e</sub> than molybdenum PE under the condition that the gas pressure was fixed at 0.3, 0.6, 1.2 Pa. Meanwhile electrified PE did not show a significant difference in I<sub>i</sub>/I<sub>e</sub> compared to molybdenum PE.