BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY

**Research Title :** Low cost microwave based plasma generation.

# Report

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# Used Equipments

- **Main Power Line:** 220V main power line.
- **Circuit Breaker:** To prevent short circuit current.
- **Power Supply:** 220V AC to High Volt. Converter.
- **Waveguide with Cooling Chamber**
- **Magnetron:** 1KW power
- **Cooling Fan:** Used for cooling the Magnetron.
- **Quartz Tube:** Used for Gas flowing.
- **Gas:** Argon
- **Water Flow:** To absorb the excessive power.
- **Pipe:** Plastic pipe used to circulate water.
- **Water Source:** From basin.
- **Scotch Tape**
- **Ignitor:** To initiate plasma for gaseous state.

# Day-1 (11th July 2023)

**Figure-1:** Magnetron & Waveguide

## Trial Run-1:

- **Run time** : 30 seconds.
- **Plasma** : Found (Auto generated).
- **Temperature** : Unknown.
- **Gas Flow** : Unchanged.

Everything seems normal after 1st run.

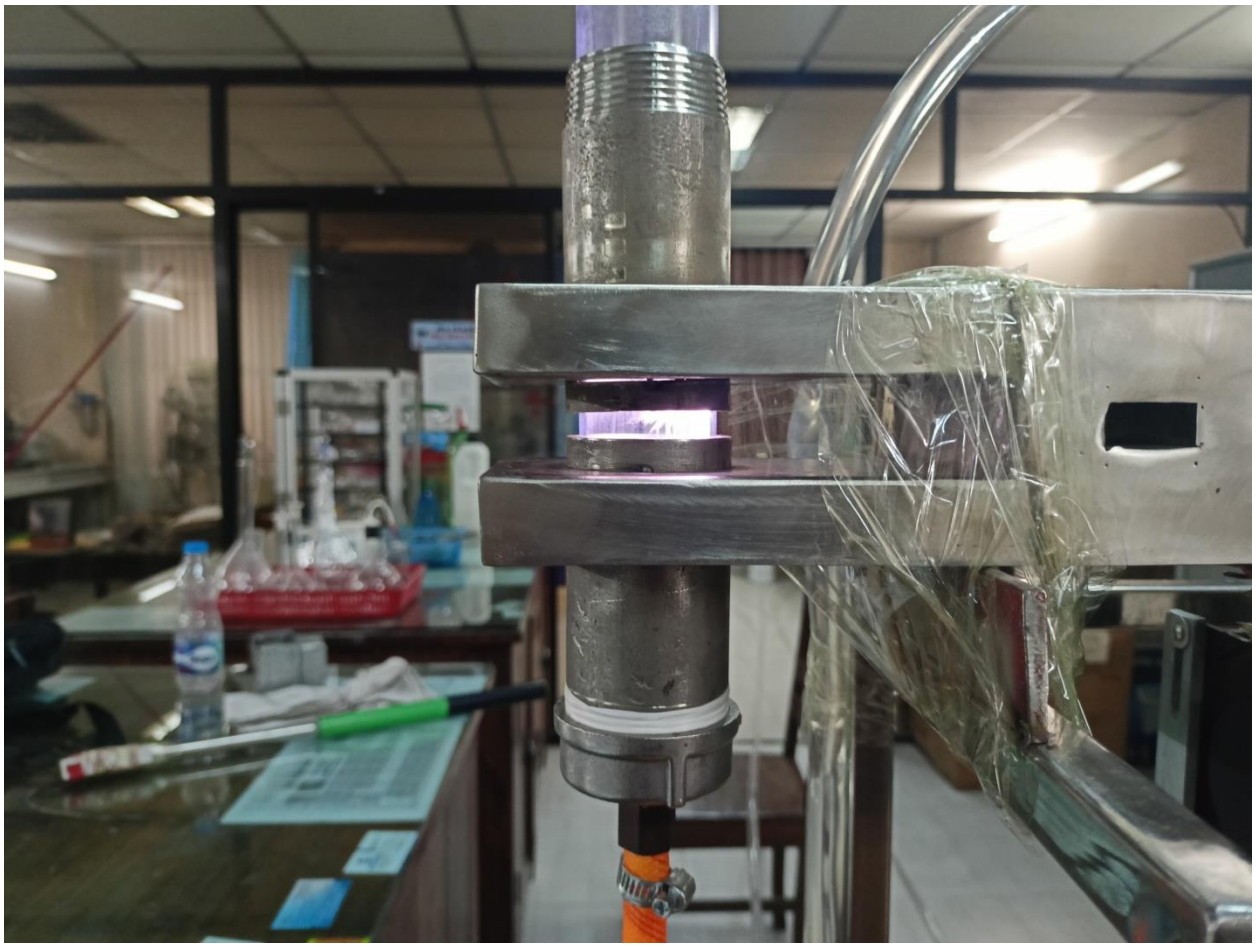

**Figure-2:** Auto ignited plasma

## Trial Run-2:

- **Run time** : 30 seconds.
- **Plasma** : Found (Auto generated).
- **Temperature** : Unknown.
- **Gas Flow** : Unchanged.

2nd run also showed normal. Nothing undesired sound or anything happened.

## Trial Run-3:

- **Run time** : 5 minutes.
- **Plasma** : Found (Auto generated).
- **Temperature** : Unknown.
- **Gas Flow** : Unchanged.

After running 5 minutes, an undesired sound appeared, then we disconnected the system from power supply as soon as possible.

**Observation after that sound:**

- Checked Magnetron. It was okay.
- Checked Quartz tube. Tube was fine but heated up as containing plasma which caused burn of the scotch tape ( bottom side of the tube).
- Didn't check the cooling chamber for the complexity.

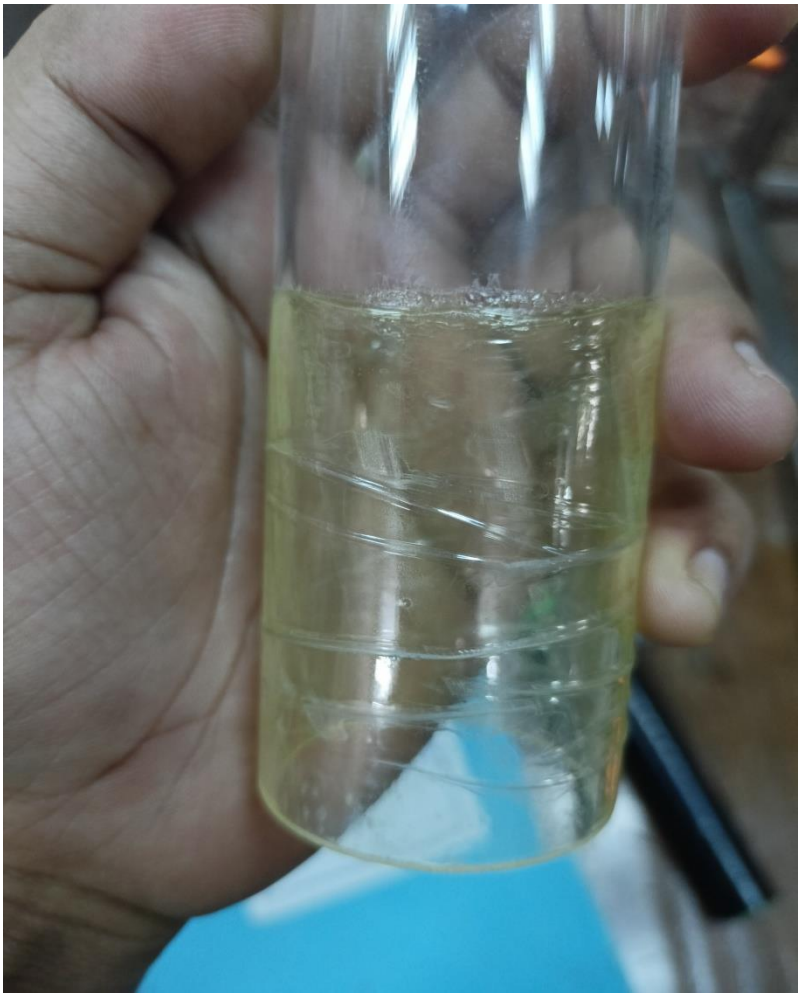

**Figure-3:** Damaged scotch tape.

## Trial Run-4:

Everything was normal like before.

## Trial Run-5:

- **Run time** : 1 minutes.
- **Plasma** : Not found.
- **Temperature** : Unknown.
- **Gas Flow** : Changed.

## Observation:

- Checked magnetron. It was fine. But it seems like magnetron operating sound reduced (lower sound than before).
- Gas flow changed but plasma wasn't found.

## Day-2 (12th July 2023)

### Trial Run-6:

- **Run time** : 1 minute.
- **Plasma** : Found after using ignitor.
- **Temperature** : Unknown.
- **Gas Flow** : Changed with time.

**Observation:**

- Plasma wasn't auto generated. When an ignitor placed in the plasma chamber, plasma was found like before.
- Apparently, didn't notice any significant change in the plasma (Color & density) while changing the gas flow.

**Figure-4:** Plasma after using ignitor.

- After system was fully turned off, leakage water found in the cooling chamber. A small part of the pipe got damaged (seems like burned) which caused leakage water.

**Figure-5:** Damaged pipe inside cooling chamber

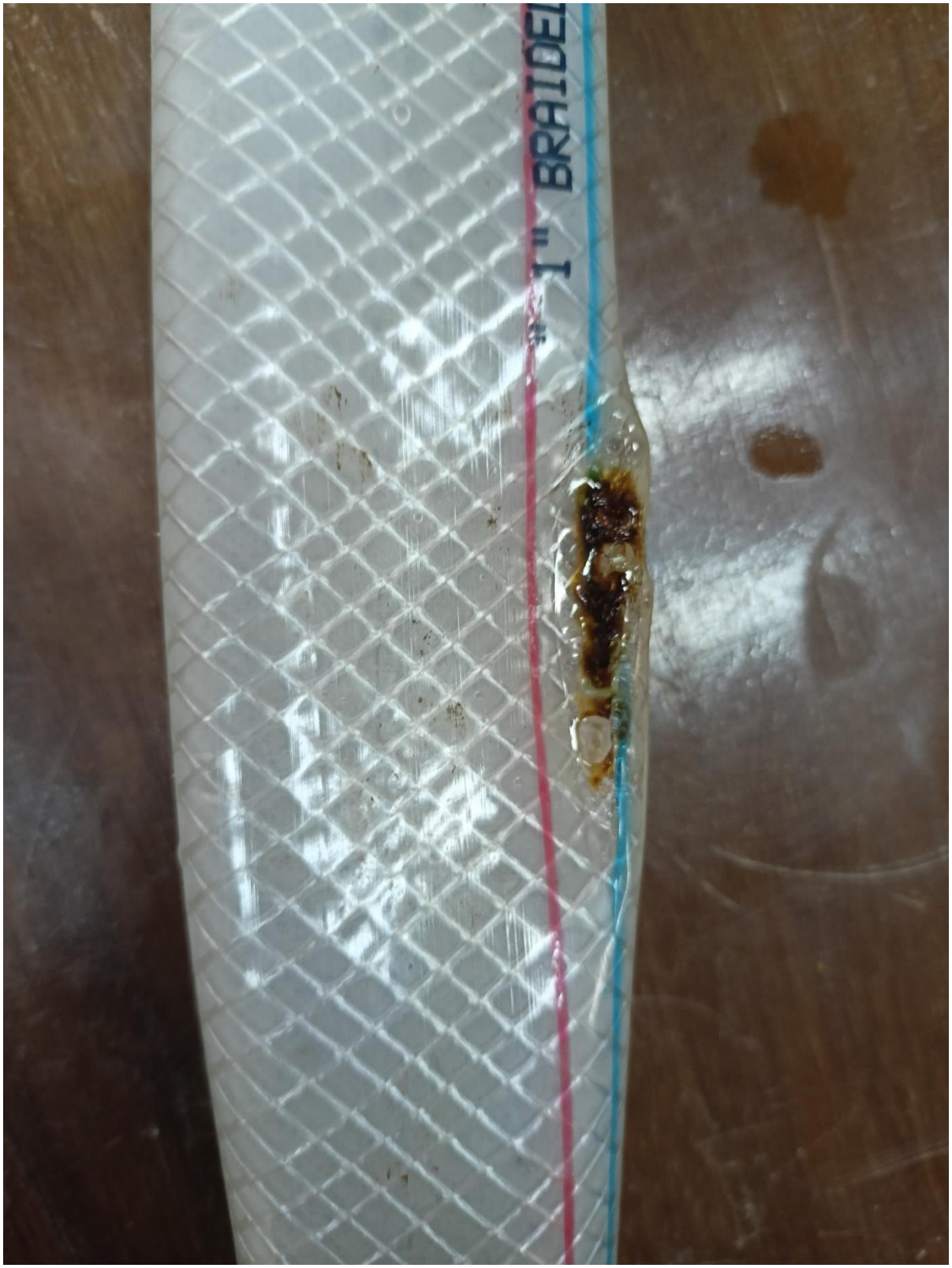


**Figure-6:** Damaged part of the cooling pipe

## Possible reasons for damaging cooling pipe:

- **Electric Field intensity:** Higher E field intensity inside the cooling chamber can damage the pipe.

- **Touching the waveguide:** As waveguide contains circulating H field inside, which causes body current of the waveguide material. Possibly this can be a reason also.

# Future Work

- Test should be done using new 1-1.5 KW magnetron for comparing plasma's state.

- Measuring of temperature of Plasma.

- Water cooling pipe should be modified. High voltage magnetron is situated just below the pipe. Any Leakage water can destroy magnetron at running condition.

- Water supply from nearby source will be more helpful for running condition.

****Necessary Equipment****

- 1-1.5 KW Magnetron ---- 3 pcs
- Pyrometer(To measure high temp.).
- Cooling pipe.