Practice quiz theoretical concepts of plasma generation

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Questions:

0 points possible (ungraded)

1. Which of the following is true for an RF plasma assuming that the top electrode is connected to the ground and the bottom electrode is connected to the RF source?

- The current passing through the ion sheath is proportional to the square of the thickness of the ion sheath
- Due to the loss of electrons to the walls, the bulk of the plasma becomes slightly negative
- After accumulation of electrons on the lower electrode, the remaining electrons in the plasma are pushed away and an ion sheath is formed near the electrode
- After a couple of RF oscillations, electrons tend to charge the top electrode

Explanation

Electrons initially will be attacking more the electrode to which the RF is applied than heavy positive ions. Therefore, a negative charge is formed on the RF electrode side after a few cycles after ignition of the plasma. Few electrons are present in the dark ion sheath near the working electrode as a result of repulsion from the negatively charged electrode. An electrical field is created, which is the ratio of the total voltage drop across the ion sheath to the ion sheath thickness. See "Theoretical concepts of plasma generation" video from 3:40 to 12:00 for more detailed explanations.

2. What can be done in RF plasma etching for enhancing the etching rate on the RF electrode side where the wafer is placed?

- The gas flow rate must be enhanced
- The frequency of the RF voltage can be increased
- The pressure inside the chamber must be increased
- The RF electrode area must be chosen smaller in size than the electrode on the opposite side

Explanation

The etching must be performed on the RF-powered electrode side. For this purpose, the voltage drop on the ion sheet must be increased which is inversely proportional to the fourth power of the electrode area ratios. In order to maximize etching on the lower electrode, one should choose the lower electrode area smaller than the upper electrode area. See "Theoretical concepts of plasma generation" video from 11:20 to 12:25 for more detailed explanations.

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