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## Practice quiz examples of etching processes for organic films and metals

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## Questions:

0 points possible (ungraded)

1. If polyimide etching is performed using an Al mask, there might be 'grass' at the bottom because of Al re-deposition. How can this problem be solved?

- ☒ The plasma can be used at a lower pressure, resulting in a higher mean free path of the sputtered material reaction products
- ☐ An erodible mask can be used instead
- ☐ After the grass formation, the wafer can be placed in an oxygen plasma chamber to remove this layer
- ☐ A thin  $\text{Si}_3\text{N}_4$  layer can be predeposited on the surface of the wafer to avoid this accumulation



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**Explanation**  
When an Al mask is used during polyimide etching, because of the etching that occurs of the Al mask, Al atoms are redeposited on the bottom of the etched features. Generally, this kind of re-deposition

phenomena can be reduced when one uses a plasma at a lower pressure, which exhibits a higher mean free path of the sputtered material reaction products, so that these can be better removed from the etching area. See "Examples of etching processes for organic films and metals" video from 2:35 to 3:35 for more detailed explanation.

2. Sometimes, in Cl plasma etching, a corrosion phenomenon is observed in Al etching under the form of chlorine-containing residues remaining on the film sidewalls. Which of the following is a correct approach to avoid this problem?

- ☒ Exposing the etched structure to a fluorine plasma immediately after the Cl plasma
- ☐ Immersing the wafer in HF
- ☐ Dipping before etching the wafer in isopropanol alcohol solution
- ☐ Applying an oxygen plasma to transform the Al completely in to  $\text{Al}_2\text{O}_3$



### Explanation

Sometimes a corrosion phenomenon is observed on the etched Al structures. This is believed to originate from Cl-containing residues that remain on the etched side walls. If these residues are combined with moisture absorption, HCl and  $\text{AlCl}_3$  molecules are formed. The problem is even more severe for Al-Cu alloys. Corrosion can be prevented by rinsing well the wafer in de-ionized water after the removal from the Cl plasma. Also, one can apply a plasma etching step in  $\text{O}_2$  to remove residual photoresist and Cl atoms and at the same time, restore a thin passivating  $\text{Al}_2\text{O}_3$  layer. Another possibility is to expose the etched structure to a fluorine plasma during which the Cl atoms are replaced by F atoms. See "Examples of etching processes for organic films and metals" video from 8:45 to 10:10 for more detailed explanations.

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