Practice quiz anisotropic wet etching of silicon in alkaline baths

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Questions:

0 points possible (ungraded)

1. Which one is an adequate bath for anisotropic Si wet etching?

- A pure HF bath
- An alkaline organic bath like EDP
- A low concentration H_2SO_4 bath
- A KOH bath with over 95% of KOH concentration in water

Explanation

Anisotropic etching is possible in different alkaline aqueous solutions like KOH, NaOH, LiOH, CsOH or NH_4OH. Another well-known example is an ethylenediamine pyrocatechol (EDP) bath. It is composed typically of 75 wt% ED, 13.5 wt% of the chelating compound pyrocatechol, 0.5 wt% of the 'smoothener' pyrazine and 11 wt% water. The etching anisotropy ratio for different Si in (111), (110) and (100) planes are 8, 50 and 200, respectively. See "Anisotropic wet etching of silicon in alkaline baths" video from 12:40 to 16:45 for detailed explanations.

2. Assuming that a Si wafer is immersed in a wet anisotropic etchant, which of the following is correct regarding the Si anisotropic etching process?

- A Si atom in a (111) plane has 2 backbonds and 2 dangling bonds
- A Si atom in a (100) plane has 3 backbonds and 1 dangling bond
- The etch rate for Si atoms in (100) and (111) planes are temperature-independent
- A Si atom in a (100) plane has a higher etching rate than a Si atom in a (111) plane

Explanation

A Si atom located in a certain plane is differently 'anchored' to the back of the substrate and has a different number of dangling bonds that are in contact with the etching solution. This can give rise to plane-dependent etching rates. A Si atom in (111) plane has 3 backbonds and 1 dangling bond whereas for a Si atom in (100) plane, there are 2 backbonds and 2 dangling bonds. Therefore, a (111) plane will etch much slower than a (100) plane in an alkaline etching bath. See "Anisotropic wet etching of silicon in alkaline baths" video from 7:20 to 8:15 for detailed explanations.

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Answers are displayed within the problem

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