INSTRUMENTAL TECHNIQUE

Ion etching and XPS depth profiling

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Etching process

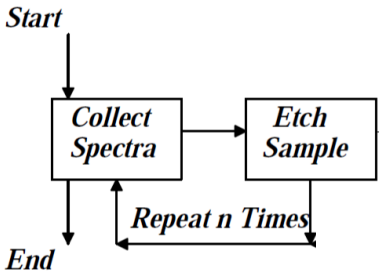
In general, there are two classes of etching processes:

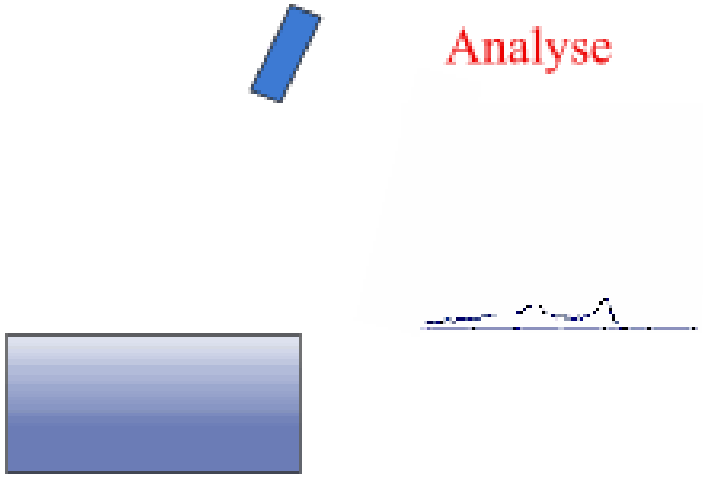
1. Wet etching where the material is dissolved when immersed in a chemical solution

2. Dry etching where the material is sputtered or dissolved using reactive ions or a vapor phase etchant

Ion implantation: XPS concentration profile

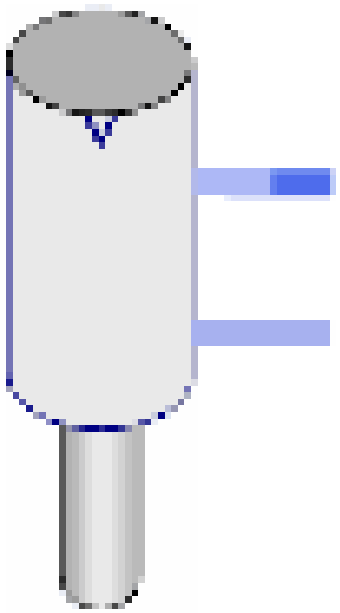
- The study of the surface composition of a material is not always sufficient. To reach the depth layers, we use an etching ion gun to clean the specimen surface more or less quickly.





Ion etching principle

- The ion beam is obtained by collision between a gas and electrons. These ions are accelerated and bombard the surface of the specimen. The ion impacts on the material pull out the superficial atoms. This etching reveals a new layer which is then characterized by XPS or AES spectroscopy.



1. The gas enters
2. Filament emits e^-
3. The gas is ionized
4. The ions are accelerated

Ion gun adjustment

The efficiency of a gun depends on several parameters:

- Used gas pressure
- Filament current intensity
- Etched surface
- Ion incidence angle

- Needle valve is used to introduce the gas into the gun. This allows a precise pressure adjustment.

Electrons are obtained from a filament by thermoelectronic emission.

The more the emission current of the filament increases and the more ions are obtained.

- By increasing the gas pressure, the electron/gas interaction is effective and the ion current can quickly grow. When this pressure will become too high, the recombination phenomenon occurs; the ions are neutralized.

- The electron/gas interaction generates the ions. These ions are accelerated and focused into a beam which can then be swept.

- At constant ion flow, the etched surface is inversely proportional to the ion current density. We can conclude that the etching speed will decrease as the etched surface becomes larger.

THANK YOU ☺