

SPIDER600

How to calculate the deposition time?

1. Introduction

In the SPIDER600, there is no shutter between the target and your substrate. This means that, as soon as the plasma ignites, it will start to sputter the target surface and coat your sample. This has two implications:

- 1) The targets, when not inside the process modules, are stored in a cabinet under atmospheric environment. Therefore, a native oxide layer might grow on the surface of the metallic targets. If you are the first one to use a target since its installation inside the tool, you need to run the cleaning recipe on a dummy wafer in order to avoid to deposit this native oxide on your sample.
- 2) The power is not applied instantaneously at its nominal value (it would damage the target) but it is usually ramped up over few seconds to a couple of minutes. This is the ramp time and its duration depends on the target materials, usually short for metallic targets and longer for dielectric targets. Since there is no shutter, you need to take the deposition during the ramp into account.

2. Deposition Time Calculation

In the following calculation, we make the assumption that the deposition rate is linearly dependent on the power applied on the plasma. Therefore, the deposition during the linear power ramp between $t = 0$ and $t = \text{Ramp Time}$ is equivalent to a deposition at constant nominal power during $(\text{Ramp Time})/2$.

Graphically, this is the area below the ramp curve which is equivalent to the area below the dotted step curve shown on the graph below.

To calculate the deposition time to enter in your recipe, you need to first calculate the thickness deposited during the ramp:

$$Thickness_{ramp} = \frac{t_{ramp}}{2} \cdot dep.rate$$

You need then subtract this thickness to your desired final thickness:

$$Thickness_{remaining} = Thickness_{final} - Thickness_{ramp}$$

From that remaining thickness, you can calculate the remaining deposition time:

$$t_{\text{remaining}} = \frac{\text{Thickness}_{\text{remaining}}}{\text{dep. rate}}$$

Therefore, the time you will need to enter in your recipe is the sum of the remaining time and the ramp time.

$$t_{\text{to enter}} = t_{\text{remaining}} + t_{\text{ramp}}$$

