MSc project

Characterization of Atomic Layer Deposition and Etch processes for Ruthenium films

**Short description:** Understanding processes for the growth and removal of Ru films, which are relevant for the semiconductor industry.

**Background:** Atomic layer deposition (ALD) is a film deposition technique which allows for deposition of ultrathin films with a good control over the film thickness, uniformity and conformality. Due to these unique features, it has found application in the semiconductor and photovoltaic industries. Currently, the method is being developed to enable area-selective ALD, meaning that material can be deposited only on areas where required. This development is driven by the semiconductor industry, since area-selective ALD allows for bottom-up device fabrication, making some commonly used lithography steps unnecessary. Recently the PMP group showed that by combining ALD with etching, area-selective ALD of Ru can be achieved (See Figure 1), which could become important for fabrication of integrated circuits.

![ALD and ALD + etching](image)

**Project:** The goal of this project is to better understand the underlying mechanisms of the ALD and etch processes as shown in Figure 1, and to further improve the method to optimize the selectivity. This will however be done using a new Ru precursor chemical, different from the one used for Figure 1. Therefore, first the ALD and etch processes are reestablished, after which further investigations will be done using a variety of diagnostic methods. In this project, you will get familiar with both ALD and thin film characterization techniques, and you will gain knowledge on materials science.

**Location and supervision:** The project will mostly consist of experimental work, performed in the main lab of the PMP group located in the Spectrum building. You will work in the Plasma and Materials Processing (PMP and you will be supervised by Martijn Vos (PhD student) and Adrie Mackus (Assistant Professor).

**Interested? For further information please contact:** Ir. Martijn Vos (Flux 3.096, m.f.j.vos@tue.nl), or Dr. ir. Adrie Mackus (Flux 3.112, a.j.m.mackus@tue.nl).