I. Physikalisches Institut (IA). Fak.01
Phasenwechselmaterialien
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Topic for a Master Thesis

# „ MOS Stress measurement signal/noise ratio optimization “

The Multi Beam Optical Sensor MOS, is an extremely sensitive laser based system for in situ, real time monitoring of thin film stress. The stress measurement is performed by monitoring the substrate curvature with an array of parallel laser beams and a CCD detector. Changes in the laser array spot spacing are used to determine the changes in sample curvature. Since all the laser spots move together at the same frequency, movement or tilt is not detected as a change of curvature and thus leads to increased curvature resolution capability, this feature is of particular use in monitoring curvature/stress during high temperature annealing. Moreover, during films deposition, the surface and overall sample reflectivity may change due to material properties and/or surface morphology.

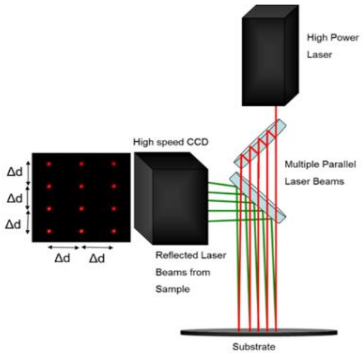


*Fig 1: Sketch of the MOS.*

Understanding and controlling stress in thin-film and thermal annealing processes is critical for achieving the desired optical, electronic, and mechanical properties. Traditional ex situ stress/strain measurement methods such as XRD or surface profiling only measure the overall stress after the process is done, but completely miss the dynamic changes in thin-film stress occurring during the process. Being able to measure the stress/strain in situ, during the process gives important insight into mechanisms and methods for controlling and targeting the overall stress induced into the sample during every step.

*Fig 2: Picture of the MYTHIC chamber.*

Currently, the MOS system is fully functional and coupled to an annealing setup, allowing us to study the stress during annealing but not during deposition, in addition, one of the sources of noise, decreasing the quality of the data are the vibrations in the chamber and surroundings. The main goal of this Master Thesis is to couple the MOS with one of our deposition chambers (i.e. Figure 2) in order to measure stress during deposition in novel materials as high entropy oxides and phase change materials.

The reactive sputtering is performed with the MYTHIC chamber, which is the abbreviation of **M**ulti-La**Y**er **Th**in F**I**lm **C**oater. It includes six independent cathodes and an automatically rotatable sample holder that positions each of the 24 possible samples exactly above the target.

The challenges are the study of the vibrations on the chamber, thermocouple calibration, designing of sample holders and small modifications to the setup and software in order to produce high quality data. The student should also understand the effects of the parameters during deposition, film growth, stress, crystal relaxation, and reflectance. Moreover, the student will also characterize the samples deposited using XRD, SEM, and UVVIS spectroscopy.

*Desirable Skills*: Experimental skills, hardware oriented person, python (basic knowledge).

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