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Determination of the deposition and energy fluxes in the industrial deposition system

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High efficiency of the sputtering process and good homogeneity of the deposited layers are among the most important issues being solved in the industry. Understanding the effects which influence both characteristics has therefore a high importance. Generally, in direct current magnetron sputtering (DCMS) higher deposition rate is provided compared to the high power impulse magnetron sputtering (HiPIMS). However, in HiPIMS higher homogeneity and overall quality of the coatings is achieved. Here a study is presented, where the influence of the process parameters on the deposition fluxes of atoms and ions in both DCMS and HiPIMS is investigated within the state of the art industrial deposition system. The direct comparison is made for the same deposition parameters such as working pressure and average power. To monitor the deposition rate and fluxes the quartz crystal monitor with biasable grids or gridless sensor with electron magnetic filter is attached on substrate holder. Measurement of the deposition flux itself is conducted by adjusting the bias voltage on the quartz crystal monitor grid. Increasing the voltage, more ions are repulsed from the grid up to the point where the whole deposition flux consists only from atoms. The energy resolved ion flux and total atom flux is obtained. By changing the position of the quartz crystal monitor spatial atom and ion flux resolution is obtained. Additionally, to directly measure the global energy transfer of the plasma to a surface, the heat flux microsensor (HFM) was employed. Such combination of diagnostic tools helps us to optimize the deposition process leading to the creation of thin films with the high quality and reproducibility.
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HiPIMS
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