Tutorial PVD

Electrical design and control concepts of sputter coating equipment

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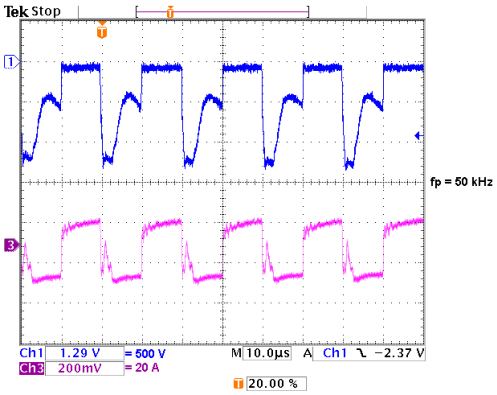
Magnetron Sputtering is a versatile tool for the deposition of high quality thin films and is widely used in Industry. Fraunhofer FEP has over 25 years of experience in the field of pulsed magnetron sputtering and collected extensive knowledge and experience ranging from hardware design and development up to process know-how for a variety of different coating materials and substrates.

One of the key components for sputtering processes is the right power supply to create and control technical pulsed plasmas. They require special attention regarding aspects of electromagnetic compatibility, safety and process control. This presentation introduces an overview of different pulse modes including DC, unipolar and bipolar and compares the respective advantages and disadvantages. In order to deposit high quality coatings, it is important to closely monitor the electrical properties of the plasma and automatically correct for disturbances. Reactive magnetron processes usually require closed control loop methods. Possible parameters for plasma process control include electrical parameters as well as spectroscopic properties. First approaches at Fraunhofer FEP using time series analysis are presented as well.



An example of Voltage and current waveforms of a pulsed plasma

During the deposition process, the power supply plays a major role in Arc recognition and handling to avoid damage of the layers. As pulsed power supplies produce voltage and current pulses causing a wide spectrum of high frequencies which may disturb measurement and control equipment, it is important to consider electromagnetic interference while designing sputter coater equipment. Measures to avoid electromagnetic interference will be discussed. Due to dangerous voltages of about 1.5 kV aspects of safety have to be considered by preliminary hazard analysis. Appropriate safety circuits have to be designed.