P 1: Invited talks I

Time: Monday 11:00–12:30 Location: P-H11

Invited Talk P 1.1 Mon 11:00 P-H11

Plasma Physics in EUV Lithography — •Iris Pilch — Carl Zeiss SMT GmbH, Oberkochen, Germany

Extreme Ultraviolet (EUV) lithography is a technology for high volume manufacturing of semiconductors. The scanners operate at a wavelength of 13.5 nm. The main parts of a scanner are the EUV light source, the illumination optics, the mask, the projection optics and the wafer stage.

The EUV source of a scanner is a laser-produced plasma (LPP) delivering high power, which is needed to ensure productivity of the maschine. For metrology applications, EUV sources with moderate or even low powers are sufficient, and both technologies LPP and discharge-produced plasmas (DPP) are common.

In this talk, an overview on EUV lithography and its next development will be given, and the different EUV source types as well as the challenges of EUV light generation will be described.

Invited Talk P 1.2 Mon 11:30 P-H11

Optical emission spectroscopy of spokes in magnetron sputtering discharges — •Julian Held, Philipp A Maass, Volker Schulz-von der Gathen, and Achim von Keudell — Experimental Physics II, Ruhr University Bochum, Germany

Spokes are patterns of increased light emission, observed to rotate in front of the cathode of magnetron sputtering discharges. They move through the plasma at velocities of several km/s in or against the ExB direction of the discharge. The often distinctly triangular shape of these features has captivated many scientists. Nevertheless, the reason for this curious shape is still not fully understood. This is because the high velocity of spokes and their initial creation at arbitrary positions render measurements challenging. Thus, more demanding plasma diagnostic techniques that require data acquisition over multiple discharge pulses require synchronization between measurement and spoke movement. In this contribution, we present optical emission spectroscopy of spokes in both high power impulse magnetron sputtering (HiPIMS), as well as direct current magnetron sputtering (DCMS). A gated camera is combined with optical filters, isolating emission lines of metal and working gas neutrals and ions. The camera is then triggered on the spoke movement, allowing us to accumulate light from several acquisitions without averaging out the spoke signal. These measurements reveal the dynamic of electrons drifting through spokes in both DCMS and HiPIMS and explain how the distinct spoke shape is formed.

Invited Talk P 1.3 Mon 12:00 P-H11

Functional coatings by atmospheric pressure plasma technology — •Kristina Lachmann, Thomas Neubert, Annika Mann, Marvin Omelan, and Michael Thomas — Fraunhofer Institute for Surface Engineering and Thin Films IST, Bienroder Weg 54E, 38108 Braunschweig, Germany

Atmospheric pressure plasma technology is well known for surface activation, functionalization and cleaning. It is also a versatile method to deposit thin films in the range of several 10 - 100 nm.

The main objective of such coatings is to achieve a higher functionality. Depending on the application, this ranges from a tailored surface tension to adhesion control or chemically reactive surfaces or antimicrobial properties. In the past, film deposition was focussed on the use of small molecules such as (silicon) organic compounds with high vapour pressures. More recently, more complex organic molecules such as fatty acids or polyphenols have also been investigated to achieve higher process sustainability and further functionalities such as soil repellency. To determine surface characteristics the analysis of these films is essential. Here, (derivatisation methods in combination with) FTIR-ATR spectroscopy, staining, investigations into soiling behaviour and the determination of surface tension by contact angle measurements are suitable methods.

In this work, we will demonstrate various applications for complete and area-selective atmospheric pressure plasma coatings not only on flat samples, but also on three-dimensional shapes.