# Workshop „Plasma Diagnostics and Modelling" – A summary

At February 7 – 8, 2018 the PSE Partner Country Workshop "Plasma Diagnostics and Modelling" organized by the University of Mons, Materia Nova and University of Namur in cooperation with EFDS took place in Mons, Belgium. The workshop addressed possibilities from plasma diagnostics and simulation to optimize and regulate especially sputtering processes. The central question was "How can I improve my process by using plasma analysis and modelling tools?"

At the first day basics and developments from research institutes were presented. The workshop started with an overview to simulation methods and their advantages and disadvantages from A. Bogaerts (University Antwerp, BEL).
Afterwards a set of possibilities to describe and optimize process parameters and coating properties were described. Starting with the measurement of energy fluxes to control and regulate processes. Here A.L. Thomann (University of Orléans, FRA) explained for instance how the measured energy flux can be used to detect chemical reactions or control process conditions.
Simulation can be used to describe the first critical point of reactive sputtering processes, to predict the discharge voltage behaviour and to understand the mechanisms behind. But there are still open challenges in the description of sputter yields and hysteresis experiments as D. Depla (University of Gent, BEL) explained.
D. Lundin (University of Paris-Sud, FRA) described, how a view on magnetron discharge currents during the processes can give information about the mechanisms of the chemical species behind. The plasma distribution and plasma properties can be analysed by optical spectroscopy methods, which gives you the opportunity to optimize coating processes.
Looking at film growth and species transportation processes simulations can be used to correlate process parameters with coating properties, but A. Hecimovic (P4G, GER) showed that it is not straight forward. He described the dependency of the ion energy distribution function from process parameters like distance and pressure.
P.H. Mayrhofer (TU Wien, AUS) gave a deeper insight to mechanisms and influences of structure defining coating parameters and simulation of coating properties depending on chemical composition and used process parameters during the deposition.

The workshop showed, that from looking to plasma diagnostics and measurement of process parameters there is a couple of possibilities to analyse process mechanisms and predict process parameters and resulting coating properties. To show, that this is not only basic science and the human curiosity to be assuaged, the presentations at the second day visualized successful industrial applications.

W. De Bosscher (Soleras, BEL) described how simulation tools are used to optimize coating process setups of plasma sources and which targets and deposition processes should be preferred to get higher deposition rates and more efficient processes for coatings on glass. Even online regulation of processes, reducing drifts and leading to higher coating homogeneities are possible.
S. Lucas (University Namur, BEL) presented tools, which can be used by applicants to simulate thin film growth and optimize process parameters to get the right coating properties.
HiPIMS processes developed over a long time period as was shown by R. Bandorf (Fraunhofer IST, GER) and were constantly optimized to get further advanced. An industrial example for process optimization of HiPIMS processes was presented by C. Schiffers (CemeCon, GER) for the development of new high performance coatings for cutting tools.
Another Example was presented by H. Wiames (AGC, BEL) who used simulation tools for the development of a new hollow cathode plasma source.

This examples showed, that diagnostics and simulation methods are not only baubles of researchers but can be used to optimize processes and support technological developments in industry.