1	CEIPEX RESEARCH TOPIC LEVEL2: plasma technologies
2	NÁZEV VÝZKUMNÉ SKUPINY: **Plasma Technologies (L. Zajíčková)**
3	TÉMA/TÉMATA **A) Pushing thin-film deposition techniques beyond their conformality limits or towards strong gradients** **B) Tuning the bioactivity of carbon-based coatings and nanoparticles**
4	ANOTACE K TÉMATU/TÉMATŮM A) Plasma enhanced chemical vapor deposition (PECVD) is gaining momentum in many areas, spanning from microelectronics (thin films in integrated circuits and memories) to biomedical applications (surface finishes for biosensors or implants). Higher integration in the case of microelectronics and sensing devices, as well as complex porous structures of implanted materials, pushes the technologies towards higher deposition conformality, enabling uniform coatings on 3D microstructures. PECVD cannot offer as high deposition uniformity as atomic layer deposition (ALD), but understanding the deposition mechanisms and using precursors that produce depositing species with low sticking coefficients can push the process towards high conformality. On the contrary, the knowledge gained about the processes can tune the deposition towards defined gradients in the film properties, an attractive approach for bottom-up structuring. The project will involve dedicated experiments with well-defined 3D microstructures to obtain information about the sticking coefficient of deposition species and the role of ions, as well as parallel tests of ALD conformality. The experiments should be supported by calculations, e.g., Monte Carlo or molecular dynamics simulations. B) Inspired by covalent bonds in proteins, in which the carboxyl group (-COOH) of one amino acid links with the amino group (-NH2) of another amino acid, surfaces aimed at the immobilization of biomolecules, as well as adhesive surfaces in general, are prepared with these functional groups. Besides through covalent bonds, immobilization can also proceed through electrostatic interactions, which can be strong for micro- and nanostructured surfaces. The polarity of amino and carboxyl groups plays opposite roles in this process. In another approach, the radicals trapped in thin films prepared by plasma processing methods are efficiently utilized for the covalent immobilization of biomolecules. The presence of unsaturated bonds, reactive in aqueous environments, raises questions about their significance. Thus, the multifunctionality of plasma-prepared materials can be leveraged to advantage by tuning their surface bioactivity. Moreover, understanding the role of various functionalities in plasma-prepared films can serve as an inspiration for understanding the bioactivity of carbon dots, which are prepared by plasma or wet chemical processes, and whose structures can contain molecular fluorophores.
5	WEBPAGE VÝZKUMNÉ SKUPINY/KONTAKT: https://www.ceitec.eu/plasma-technologies/rg386