

19th World Congress on

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Two- and three-dimensional multilayer bio-coatings as novel drug delivery systems. From nano to micro

Polymer multilayers first introduced about two decades ago are nowadays widely used towards bio-applications in tissue engineering and regenerative medicine. Our research is focused on active 2D and 3D multilayer structures (e.g. planar films, capsules, beads) with tailor-made properties. Such structures have a fine-tuned architecture, controlled thickness from nano to macro, adjusted softness from Pa to GPa, almost unlimited variety of functional components, and externally activatable drug release. In this talk I present our recent findings in mild and effective immobilization of biomolecules (proteins, nucleic acids, small drugs, etc) and approaches for release/delivery the biomolecules in a controlled manner. The externally triggered release on demand by IR-laser light and cell biology studies including extra- and intra-cellular delivery will be considered. The developed structures offering localized, remote, and non-invasive release of biomolecules are indispensable for applications in tissue engineering, and especially for single cell studies where high precision of delivery in space and time is highly desirable.



Recent Publications

1. Volodkin D & von Klitzing R (2014) Competing mechanisms in polyelectrolyte multilayer formation and swelling: Polycation–polyanion pairing vs. polyelectrolyte–ion pairing. *Curr Opin Colloid Interface Sci* 19: 25-31.
2. Volodkin D (2014) CaCO₃ templated micro-beads and -capsules for bioapplications. *Adv Colloid Interface Sci* 207: 306-324.
3. Prokopovic VZ, Duschl C & Volodkin D (2015) Hyaluronic Acid/Poly-L-Lysine Multilayers as Reservoirs for Storage and Release of Small Charged Molecules. *Macromol Biosci* 15: 1357-1363.
4. Vikulina AS, Anissimov YG, Singh P, Prokopovic VZ, Uhlig K, Jaeger MS, von Klitzing R, Duschl C & Volodkin D (2016) Temperature effect on the build-up of exponentially growing polyelectrolyte multilayers. An exponential-to-linear transition point. *PCCP* 18: 7866-7874.
5. Prokopovic VZ, Vikulina AS, Sustr D, Duschl C & Volodkin DV (2016) Biodegradation resistant multilayers coated with gold nanoparticles. Towards tailor-made artificial extracellular matrix. *ACS Applied Materials & Interfaces* 8: 24345-24349.

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Biography

Dmitry Volodkin is Associate Professor at Nottingham Trent University and heads the group "Active-Bio-Coatings". He has studied Chemistry at the Lomonosov Moscow State University in Russia. Research stays brought him to France (University of Strasbourg) and Germany (Max-Planck Institute of Colloids and Interfaces, Technical University of Berlin, Fraunhofer Institute for Cell Therapy and Immunology). His research activities are focused on design of advanced stimuli-responsive biomaterials for applications in tissue engineering, diagnostics, toxicology, drug delivery. His group engineer self-assembled polymer-based 2D and 3D structures with tailor-made properties: multilayer films, microcapsules and beads, liposome-polymer composites, polymeric scaffolds, etc. Dmitry Volodkin has published more than 70 peer-reviewed articles/books and received a number of prestigious scientific awards such as Sofja Kovalevskaja Award of Alexander von Humboldt Foundation, Richard-Zsigmondy Price of German Colloid Society, Alexander von Humboldt Fellowship, Marie Skłodowska-Curie Fellowship.

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