

Polymer Chemistry

30th International Conference on

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Materials Chemistry & Science

August 27-28, 2018 | Toronto, Canada

Versatile approach to polyelectrolyte multilayer films with enhanced stability using functionalized polyelectrolytes

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The past few decades have witnessed a rapid development of polyelectrolyte-based materials in different fields, such as cosmetic, concrete and cement formulation (superplasticizer), water treatment (membrane), drug delivery, tissue engineering, and surface coating, especially via the formation of Layer-by-Layer (LbL) polyelectrolyte films. Advances in this field impose challenges on the development of functionalized polyelectrolytes (PEs). In this presentation, a general approach to side-chain allylfunctionalization of three different polyelectrolytes (PEs), namely poly(allylamine) hydrochloride (PAH.HCl), branched polyethyleneimine (PEI) and poly(sodium 4-styrene sulfonate) (PSS), currently developed in our laboratory, will be presented. The application of the resulting functional polyelectrolytes (PSS-ene, PAH-ene and PEI-ene) in the buildup of LbL films with enhanced stability under extreme conditions of pH and high ionic strength will also be discussed. Such stability is achieved thanks to the presence of allyl groups not only on PEs-ene but also on the substrate (called substrate-ene) which allows for photocrosslinking between different layers of PE-enes and also with substrate-ene in the presence of a water-soluble dithiol crosslinking agent via "click" thiol-ene chemistry. The feasibility of this approach has been demonstrated both on a gold model substrate and on an AMX-type anion exchange membrane, both previously functionalized with allyl groups either by sulfur-gold chemistry or by chemical reduction of aryldiazonium salts, respectively. The versatility and effectiveness of the approach reported here are expected to find widespread interest in different fields of emerging applications, including advanced membrane separation and purification, antifouling and bioactive surface engineering, soft nanotechnology and self-assembly.

Biography

Thi-Thanh-Tam Nguyen has received her PhD in Organic Synthesis and Material-Polymer Chemistry in 2009 at the University of Strasbourg with Dr. Philippe Mesini. After two years working as postdoctoral fellow at Max-Planck Institute for Polymer research (MPIP, Mainz, Germany) in the group of Prof. K. Mullen about the design and the synthesis of photoresponsive polyphenylene dendrimers, she joined Dr. A. Wagner to work in the synthesis of bioactive molecules at the Faculty of Pharmacy in Strasbourg and then worked as temporary assistant professor at the Ecole Normale Supérieure (ENS de Lyon) with Dr. Cyrille Monnereau. In 2015, she was appointed as the lecturer in the University Paris-Est Creteil and currently works in the group of Dr. D. Grande. Her main research interest is about the synthesis and the characterization of polyelectrolyte/thermosetting polymer-based materials with controlled morphology and functionality for miscellaneous applications

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