Applicability of polymeric substrates for subcellular live cell micropatterning experiments

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Abstract

Polymeric materials play an emerging role in the development of new biomedical and biosensing interfaces. Within this regard, polymeric substrates can serve as a superior surface for binding and patterning of biomolecules. However, detailed information about the applicability of different polymers for surface functionalization and quantitative fluorescence microscopy is missing. Therefore, we characterized eleven different polymer foils and glass as a reference: cyclic olefin polymer (COP), cyclic olefin copolymer (COC), poly(methylmethacrylate), polyethylene terephthalate (PET), poly(methylmethacrylate), plasma polymerized poly(methyl methacrylate) (PMMA), di-acetate, poly(vinyl alcohol), cellulose acetate (C), poly(ether ester) (PEE), poly(etheretherketone) (PEEK) and poly(etherketone) (PEK). We have recently introduced two different approaches microcontact printing (µCP) and photolithography for the fabrication of biomolecule micropatterns on various functionalized polymer substrates. [1, 2]. However, the implementation of photolithographic approaches for the fabrication of microstructured surfaces is expensive and labor-intensive compared to µCP. Hence, we focused on µCP for the fabrication of biomolecule micropatterns. The absence of functional groups in many polymeric materials does not allow for the immobilization of biomolecules onto these substrates by means of common surface chemistry. Therefore, we used plasma activation and wet chemistry for the introduction of functional groups on these surfaces and evaluated the coating performance via contact angle measurement and scanning electron microscopy (SEM). We gathered information about transmission and absorption properties of the different polymers via UV-VIS spectroscopy. Furthermore, we give an overview about their suitability for epifluorescence and total internal reflection fluorescence (TIRF) microscopy and evaluated these methods via contrast measurement. In addition, we tested these micropatterned polymers concerning their applicability in cell-based protein-protein interaction assays. Overall, we tested eleven different polymer substrates to evaluate their suitability for fluorescence microscopy and subcellular live cell micropatterning assay. COP, COP and PMMA turned out to be cheap and flexible alternatives to glass substrates with comparable chemical and optical properties.

References


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Acknowledgements

This research is funded by the Christian Doppler Forschungsgesellschaft (Josef Ressel Center for Photogenetic Drug research) and the Province of Upper Austria.