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Synthesis, polymerization and characterization of dye-labeled polymethacrylate brushes

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Synthesis, polymerization and characterization of dye-labeled polymethacrylate brushes

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In the project, the dynamics of wetting of the poly(di(ethyleneglycol) methyl ether methacrylate) (PDEGMA) brushes is studied by analyzing the fluorescence dynamics of a solvatochromic reporter dye. In particular, poly(di(ethyleneglycol) methyl ether methacrylate) brushes with an overall uniform height, containing a solvatochromic dye, which is able to probe the local polarity in its vicinity [1], covalently attached to the brushes in a one-dimensional depth gradient, should be employed to image the wetting dynamics with confocal fluorescence microscopy both with high lateral as well as enhanced axial resolution. Gradient brushes [2] were successfully synthesized by surface-initiated activator regenerated by electron transfer, atom transfer radical polymerization (SI-ARGET ATRP) with inverse gradient directions exploiting two consecutive polymerizations. Linear gradient brushes with dry thicknesses from 50 nm up to 400 nm were obtained and the polymerization of a second and a third block to obtain an overall uniform height was accomplished with a reinitiation efficiency of > 80%. The introduction of a short second block of a co-monomer between those two gradient polymerizations was achieved to obtain a unique block copolymer brush architecture. In this contribution, the synthesis, polymerization and characterization of a dye-containing co-monomer will be presented, along with the synthesis of precisely tuned probe molecules based on Nile red and aurone units as fluorescent probes for the detection of local polarity and mobility of the environment in the polymer. Copolymerization of PDEGMA and this Nile red-based dye-containing methacrylate will be presented as an attempt to affect the local surrounding of the dye. Fluorescence lifetime imaging microscopy (FLIM) imaging of such surfaces in dry and wet conditions was conducted to characterize effects of the surface wetting. In the future the incorporation of other dye methacrylates into the gradient brush architecture will be attempted, to finally investigate the wetting dynamics of these polymer brush systems.

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References

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