Science Days TCH 2025 Abstract Submission

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Micropatterning Confined Surfaces with Polymer Brushes via Two-Photon-Initiated RAFT Polymerization

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To ensure their intended functionality, exact control over material surface properties is necessary when biological systems are in contact with them. Excellent options for on-demand surface modification include polymer brushes which are used in tissue engineering substrates, microelectronic components, biosensors, and microfluidic devices.[1] Existing brush fabrication methods include photomasks and direct laser writing, but are limited in patterning resolution. In this study, polymer brushes were photopatterned on confined glass substrates using two-photon initiated reversible addition fragmentation chain transfer, 2PRAFT.[2] The biocompatible and hydrophilic monomer N-acryloylmorpholine was chosen to synthesise the polymer brushes. The system was first optimised via RAFT polymerisation and blue light irradiation to establish polymerisation solution composition. Glass wafers were covalently modified with RAFT agent 4-cyano-4-(((dodecylthio)carbonothioyl)thio)pentanoic acid (CDTPA) via a two-step procedure, using Ivocerin as the photoinitiator. Brush formation kinetics were monitored, and brush thickness was measured by ellipsometry, with a maximum of 10.4 ± 1.5 nm. X-ray photoelectron spectroscopy (XPS) was used for the determination of the brushes' chemical composition. The developed system was further extended to two-photon-initiated RAFT (2PRAFT) polymerisation, utilising a well-known 2P fabrication initiator. The patterned polymer brushes and their morphology were analysed using confocal laser scanning microscopy (CLSM) and atomic force microscopy (AFM). This method demonstrated its versatility through the capability to print multicoloured patterns and also to print on vertically stacked surfaces.

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References:
[1] Zoppe, J.O.; Ataman, N.C.; Mocny, P.; Wang, J.; Moraes, J.; Klok, H.A. Surface-Initiated Controlled Radical Polymerization: State-of-the-Art, Opportunities, and Challenges in Surface and Interface Engineering with Polymer Brushes. Chem. Rev. 2017, 117, 1105–1318, DOI:10.1021/acs.chemrev.6b00314
[2] Helfert, S.; Zandrini, T.; Rohatschek, A.; Rufin, M.; Machata, P.; Zahoranová, A.; Andriotis, O.G.; Thurner, P.J.; Ovsianikov, A.; Liska, R.; Baudis, S.; Micropatterning of Confined Surfaces with Polymer Brushes by Two-Photon-Initiated Reversible Addition–Fragmentation