ADVANCED POLYMERIZATION TECHNIQUES IN SURFACE ENGINEERING.

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The development of reversible deactivation radical polymerization (RDRP) methods, such as atom transfer radical polymerization (ATRP), has enabled the creation of densely packed polymer brushes by offering precise control over polymer chain length, distribution, and structural characteristics. Leveraging these attributes and combining with a wide variety of functional monomers allows us to impart desired properties, including hydrophobic or hydrophilic characteristics, bio-resistant or bioactive features, stimuli-responsive behaviour, low-friction attributes, anti-corrosiveness, etc [1]. Photoinduced atom transfer radical polymerization (photo-ATRP) offers several advantages compared to other ATRP methods due to its cost-effectiveness, improved tolerance towards oxygen, milder reaction conditions, and the ability to achieve temporal control over polymerization without the need for additional chemicals [2, 3]. These characteristics of photoATRP in surface modification via surfaces-initiated photoATRP make it an invaluable tool for the synthesis of well-controlled polymer brushes over large areas, using minimal reaction volumes [4].
This work presents the synthesis of highly dense and uniform poly(α-methylene-γ-butyrolactone) (PMBL) brushes on Si-wafers. Utilizing custom-made polymerization setups ensured a high level of uniformity across the substrate, even at the edges. Notably, one of our setups facilitates PMBL brush growth in open air, a novel finding. Synthesis was successfully replicated under natural sunlight and in complete darkness after brief UV exposure, offering potential economic benefits. Moreover, the reaction mixture proved reusable for up to two cycles, resulting in PMBL brushes exceeding 40 nm in thickness. Encouraged by these findings, we extended the process to include modification of other surface oxide layers.

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