



Direct Quantitative Characterization of Polymer Brushes Obtained by Surface-Initiated ATRP on Silicon

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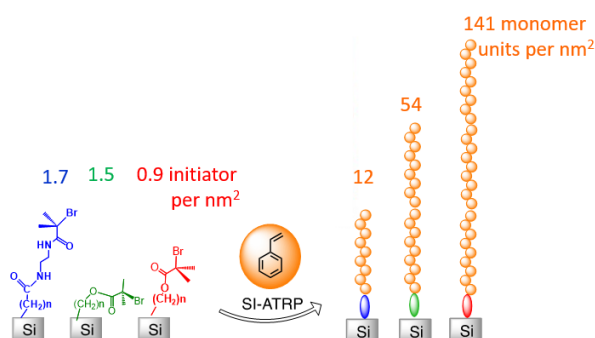
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Hydrogenated silicon surfaces are excellent starting points for the covalent grafting of functionalized organic monolayers and polymers through strong Si-C bonds. Thanks to the high quality of the interfaces in terms of chemical and electrochemical stabilities, these hybrid substrates naturally find applications in many fields such as in (bio)sensors, molecular electronics or in photovoltaics.^{1,2} To achieve such properties of the interface, it is mandatory to develop reproducible chemistries. In this context, the hydrosilylation route is well-adapted for the formation of rather dense monolayers allowing further chemical/biological post-modifications. We have developed quantitative tools by FTIR spectroscopy using the silicon (111) as the ATR element in order to control and optimize the composition and the nature of the grafted chains.

As an example, I will present the (multi-step) grafting of a polymerization initiator for the obtention of high density polystyrene brushes by Surface-Initiated Atom Transfer Radical Polymerization (SI-ATRP).³ In the SI-ATRP modification, the main drawbacks are the difficulty of analyzing the length of the polymer chains grafted onto the surface as well as the grafting density. This is generally realized by indirect methods either by detaching the grafted polymer chains from the surface or by analyzing the bulk polymers obtained by addition of sacrificial initiators to the polymerization solution.

For the first time, I will show that ATR-FTIR quantification together with AFM imaging offers an alternative to the indirect classical methods to directly evaluate the degree of polymerization of grafted brush polymers, the surface density and the proportion of active initiators. This approach is fully generalizable to any other polymer system and other controlled radical polymerization. We aim at using such a full characterization of such polymer brushes for applications in asymmetric catalysis.



References

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