Designing Polymer Hybrid Materials via Modular Synthetic Strategies

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The lecture will describe how modular synthetic strategies in polymer chemistry can be employed to not only construct highly defined complex macromolecular architectures, yet also be utilized for the generation of switchable interfaces and surfaces designs. The specific chemistries to be addressed include fast, quantitative and mild ligations *via* thermally and photochemically triggered pericyclic reaction chemistries, including those based and o-quinodimethane photo-precursors (see Figure 1)[1] and nitrile imine-mediated tetrazole-ene cycloaddition (NITEC) reactions (see Figure 2).[2] In addition to an introduction of these underpinning chemistries with examples from solution chemistry, particular attention will be placed on dynamic covalent chemistries on surfaces (see Figure 3)[3] as well as the ability to photo-pattern surfaces with variable macromolecular, small molecule and specifically biomarkers in a spatially resolved fashion (see Figure 4).[4] In addition, the ambient temperature modification and characterization of nano-objects – including fullerenes and single-walled carbon-nanotubes (see Figure 5)[5] – *via* pericyclic reactions will be addressed. The synthetic and materials design efforts will be underpinned by the in-depth characterization of the obtained arrays (e.g. *via* x-ray photoelectron spectroscopy (XPS) and ToF-SIMS measurements) and their precursor macromolecular materials (e.g. *via* hyphenated chromatographic techniques including SEC-ESI-MS and LACCC-SEC).

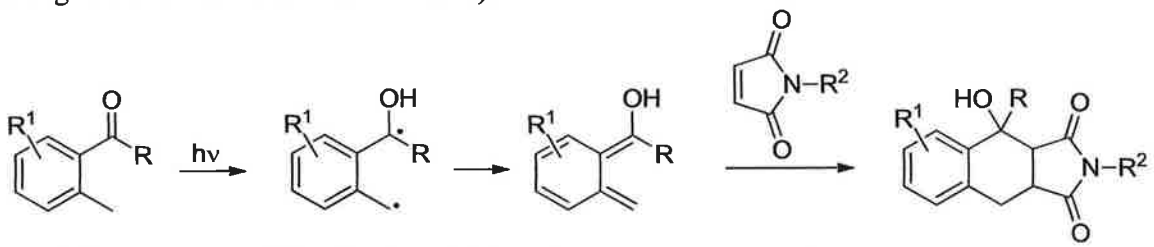

Figure 1 Photo-triggered [2+4] cylcoaddition chemistry employed for the construction of complex macromolecular designs and spatially addressable surfaces.

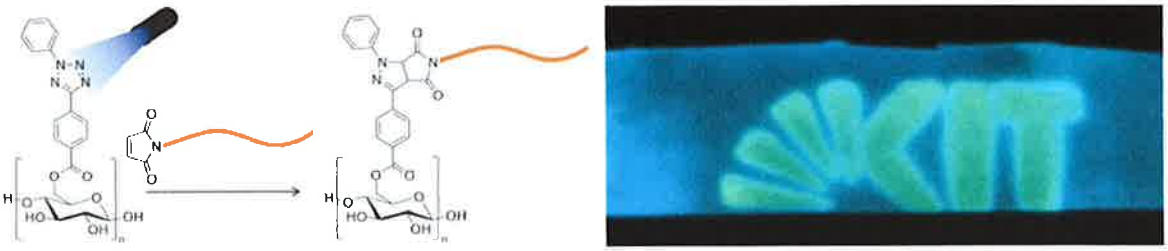

Figure 2 Functionalization of profluorescent biomaterials via NITEC with precision engineered macromolecules to create spatially resolved fluorescent biosurfaces.

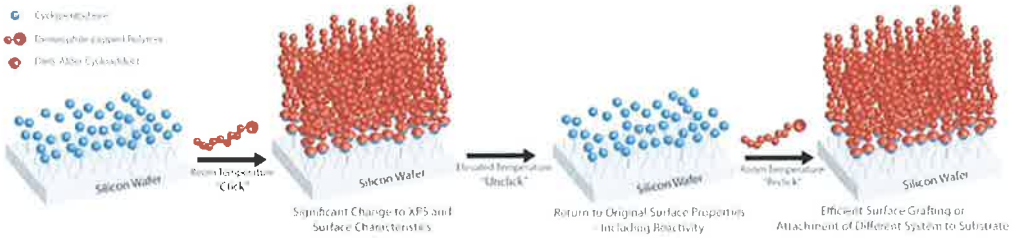

Figure 3 Dynamic covalent reaction cascade employing ambient temperature [2+4] macromolecular ligation chemistry on silicon substrates.

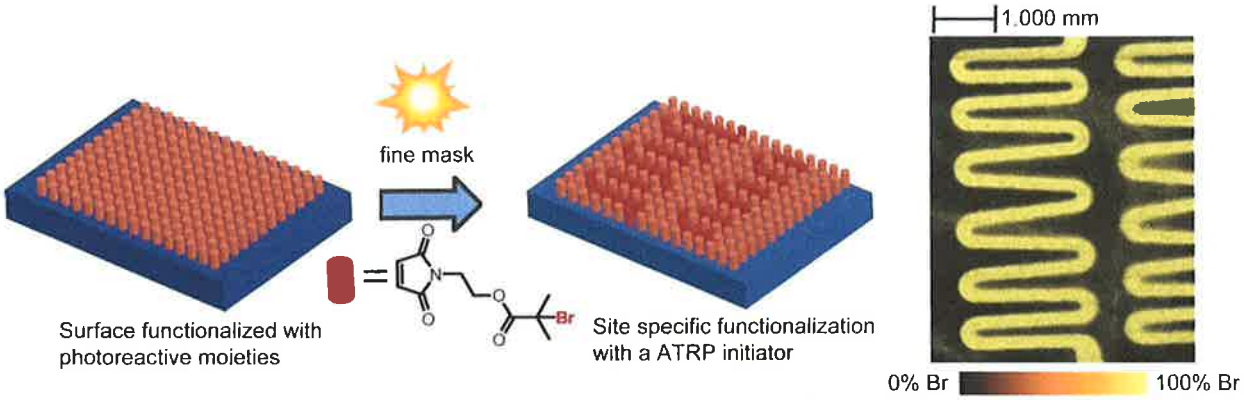

Figure 4 ToF-SIMS image (right) of spatially resolved photo-triggered functionalization of silicon wafers via photoenol chemistry.

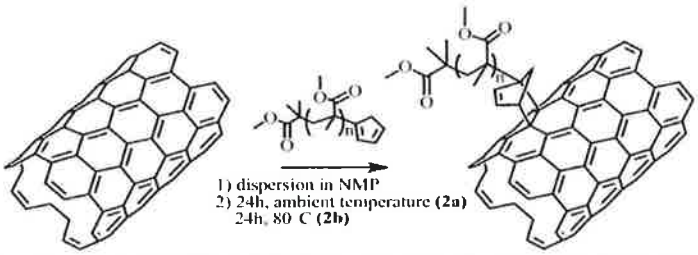

Figure 5 Ambient temperature functionalization of Single Walled Carbon Nanotubes via [2+4] cycloaddition with well-defined polymeric strands.

References

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