MILD AND MODULAR SURFACE MODIFICATION OF CELLULOSE VIA HETERO DIELS-ALDER (HDA) CYCLOADDITION

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ABSTRACT

A combination of Reversible Addition Fragmentation Chain Transfer (RAFT) polymerization and hetero Diels-Alder (HDA) cycloaddition was used to effect – under mild ($T \approx 20°C$) and modular conditions – the grafting of poly(isobornylacrylate) onto a solid cellulose substrate (Cel-*g*-piBoA).[1] For this purpose the active hydroxyl groups expressed on the cellulose fibers were substituted by a highly reactive cyclopentadienyl functionality (Cp). By employing the reactive Cp-functionality as a diene, thiocarbonyl thio capped poly(isobornylacrylate) synthesized via RAFT polymerization was attached to the surface under ambient conditions via a HDA cycloaddition.

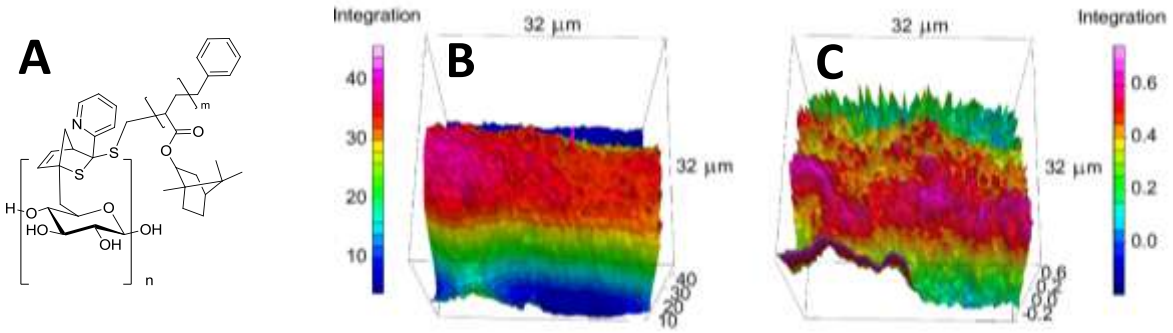

Figure 1. *A) Structure of surface-modified cellulose (Cel-g-piBoA). False color high resolution FT-IR microscope images of (B) Cel-g-piBoA integration 950-1200 cm^{-1} (characteristic cellulose region) and (C) Cel-g-piBoA integration 1700-1750 cm^{-1} (C=O stretching vibration, characteristic for the grafted polyacrylate).*

The surface-modified cellulose samples were analyzed in-depth by X-Ray photoelectron spectroscopy, scanning electron microscopy, elemental analysis, Fourier transform infrared (FT-IR) spectroscopy as well as Fourier transform infrared microscopy. The analytical results provide strong evidence that the reaction of suitable dienophiles with Cp-functional cellulose proceeds under mild reaction conditions in an efficient fashion. Especially the visualization of individual modified cellulose fibers via high resolution FT-IR microscopy corroborates the homogeneous distribution of the polymer on the cellulose fibers (**Figure 1**). These cellulose systems can lead to significant advances in the field of reversible coatings of cellulosic materials.

Reference:

(1) Goldmann, A. S.; Tischer, T.; Barner, L.; Bruns, M.; Barner-Kowollik, C.; *Biomacromolecules*, **2010**, in press.