ENZYMATIC PATTERNING OF PHASE SEPARATED BICOMPONENT BIOPOLYMER THIN FILMS

Katrin Niegelhell[a], Michael Süßenbacher[a], Katrin Jammernegg[a], Thomas Ganner[b], Daniel Schwendenwein[c], Helmut Schwab[c], Franz Stelzer[a], Harald Plank[b], Stefan Spirk[d]

[a]Institute of Chemistry and Technology of Materials, Graz University of Technology, 8010 Graz, Austria
[b]Institute for Electron Microscopy and Nanoanalysis, Graz University of Technology, 8010 Graz, Austria
[c]Institute for Molecular Biotechnology, Graz University of Technology, 8010 Graz, Austria
[d]Institute for Paper-, Pulp- and Fibre Technology, Graz University of Technology, 8010 Graz, Austria.

In this contribution, we present the fabrication of micro phase separated blend thin films, composed of PHB (poly-3-hydroxybutyrate) and cellulose in order to generate patterned polymer surfaces. This is of high interest due to the requirement of a variety of surface morphologies for thin film applications in various fields. Blend thin films were prepared in different ratios via spin coating of PHB/TMSC (trimethylsilyl cellulose) solutions followed by regeneration of TMSC to cellulose afterwards. The thin films were investigated in terms of thickness, surface free energy, surface roughness and morphology. Moreover, the extent of nonspecific protein adsorption was tested for the herein examined films at the example of Bovine Serum Albumin. Enzymatic structuring was performed with either PHB-depolymerase or cellulase. Atomic force microscopy studies of enzyme treated surfaces reveal complete removal of PHB or cellulose and display features in the nano and micro size range depending on the blend ratio. Additionally, enzyme-substrate interaction of PHB-depolymerase was studied by means of multi-parameter surface plasmon resonance spectroscopy, showing extremely fast PHB degradation compared to other enzymes of this kind.