Ulrich Scheler, J Nanomed Nanotechnol 2014, 5:5
http://dx.doi.org/10.4172/2157-7439.S1.017

OMICS Group Conferences
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4th International Conference on
Nanotek & Expo

December 01-03, 2014 DoubleTree by Hilton Hotel San Francisco Airport, USA

Interfaces and molecular mobility in polymer nanocomposites

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While the modification of inorganic fillers like LDH required for the compatibilty to non-polar polymers can be followed by 27Al solid-state NMR, the investigation of the polymer in the vicinity of the inorganic filler still remains a challenge. Two approaches are discussed here. The high sensitivity of EPR permits the investigation of thin polymer films on solid substrates. Careful simulation of the cw EPR line shapes reveal distribution of correlation times and information on the geometry of the motion as demonstrated for polyelectrolyte multilayers and the effects of the variation pH on the local dynamics. Solid-state NMR employing selective excitation of magnetizaion in the filler with subsequent magnetization transfer to the polymer allows the NMR investigation of the near-interface polymer and comparison to the bulk. Samples prepared from polyelectrolyte multilayers with different polymers establish a "ruler" for the length scales involved. Thus a gradient of properties like local mobility from the interface to the bulk can be determined. Relaxation NMR combined with homonuclear decoupling during the acquisition combines the high sensitivity of proton NMR with chemical shift resolution sufficient to distinguish functional groups on the polymer and to separate signals from a solvent. The enhanced mobility of polymer brushes compared to bulk polymer has been observed as well as distinct differences in the swelling behaviour of the brushes compared to the bulk material of the same molecular weight.

Biography

Ulrich Scheler has completed his PhD at the age of 29 years from the University in Mainz following work at the Max-Planck-Institut für Polymerforschung. After postdoctoral research at the University of Durham, UK, he joined the the Leibniz-Institut für Polymerforschung Dresden e.V., where he is currently head of the Department Polyelectrolytes and Dispersions. He has published more than 80 papers in reputed journals.

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