高分子科学系列讲座

高分子物理与化学国家重点实验室 中国科学院长春应用化学研究所

序　　号	PS2012-13	**总 序 号**	PSLAB135-PS2012-13
报 告 人	Stephan Förster	**职　　称**	Professor
从事专业	高分子物理化学		
建 议 人	门永锋	**主 持 人**	韩艳春
报告时间	2012 年 6 月 8 日 15：00	**报告地点**	主楼 410
单　　位	Physical Chemistry I, University of Bayreuth, Germany		
通讯地址/邮编	Physical Chemistry I, University of Bayreuth, 95440 Bayreuth, Germany		
电　　话	+49 (0) 921/55-2760	**电子邮箱**	stephan.foerster@uni-bayreuth.de

报告人背景

1989 Diploma with Prof. Dr. G. Wegner, MPI für Polymerforschung, Mainz

1992 Ph.D. with Prof. Dr. M. Schmidt, MPI für Polymerforschung, Mainz

1992-1993 PostDoc with Prof. Dr. F. S. Bates, University of Minnesota, Minneapolis (U.S.A.)

1993-1999 staff scientist with Prof. Dr. M. Antonietti, MPI für Kolloid- und Grenzflächenforschung, Golm

1999 Habilitation, University of Potsdam

2000 Professor, University of Hamburg

Honors

1986 Auslandsstipendium (Deutscher Akademischer Austauschdienst, DAAD)

1989 Promotionsstipendium (Fonds der Chemischen Industrie, FCI)

1992 Postdoktorandenstipendium (Deutsche Forschungsgemeinschaft, DFG)

1996 Vortragsreisestipendium (Gesellschaft Deutscher Chemiker, GDCh)

1998 Dr.-Hermann-Schnell-Preis (Gesellschaft Deutscher Chemiker, GDCh)

2004 Call to Professorship at University of Karlsruhe (declined)

Memberships and Services

1996- Gesellschaft Deutscher Chemiker (GDCh)

1996- Deutsche Physikalische Gesellschaft (DPG)

2001-2005 Editor of POLYMER

2002-2004 Member of the Subcommitee "Structure and Dynamics of Soft-Condensed Matter", ILL, Grenoble

2003- 2005 Photon Science Committee of DESY, Hamburg

2005-2009 Editorial Advisory Board of POLYMER

2008 Editorial Advisory Board of Macromolecular Chemistry and Physics

2008 Elected Reviewer (Fachkollegiat) of the German Science Foundation (DFG)

Reviewer for the Deutsche Forschungsgemeinschaft (DFG), VolkswagenStiftung, National Science Foundation (NSF), Helmholtz-Gemeinschaft (HGF), Israel Science Foundation (ISF), Dutch Science Foundation (NWO), French Science Foundation (ANR)

Research focuses on how structures on the nano- and mesoscale emerge and develop, and how they can be integrated into systems with specific functions.

报告题目	FULLY MISCIBLE POLYMER NANOCOMPOSITES
内容摘要	Polymer nanocomposites have gathered substantial academic and industrial interest since the first reports in the early 1990s. Observations of large property changes at very low volume fractions of added nanoparticles, and the possibility to integrate nanoparticles with specific properties providing new functions have motivated an increasing number of investigations. Further progress in nanocomposites is crucially limited by the strong tendency of nanoparticles to aggregate in polymeric matrices, a complication that also prevents a clear identification of the underlying nanoscale mechanism that leads to the striking efficiency of nanocomposites. We discovered that coating nanoparticles with a brush-like polymer layer provides a general and versatile route to fully miscible nanocomposites that show no nanoparticle aggregation over the whole range of nanoparticle volume fractions. [1] In a spherical polymer brush, the polymer chains are attached with one end to the particle surface. The chain ends may be attached covalently, but we found that a more versatile and simpler approach was to attach the polymers via coordinative interactions. We demonstrate the generality of this approach with the preparation of fully miscible metal (Au, Ag), oxide (ZnO, Fe2O3), sulfide (PbS) and selenide nanoparticles (CdSe) having catalytic, magnetic, or semiconducting properties in polymers such as polyethylene, polyisoprene, polystyrene, and polyethylene oxide. Optically transparent materials with nanoparticle weight fractions of more than 40% can be obtained. Fully miscible nanocomposites enable for the first time to identify the relevant nanoscale mechanism that improves the efficiency of nanocomposites, revealing important parallels to the behavior of colloidal solutions. Our experiments show that the observed improvements of the mechanical properties derive from nanoparticle-induced retardation of polymer chain mobility and a liquid-solid transition induced by the mutual interaction of the nanoparticles. Both effects are mediated by the interfacial polymer layer already at very low volume fractions. In miscible nanocomposites nanoparticles assemble into superlattices with unprecedented order, which allows excellent control of the interparticle distance in polymeric matrices relevant for applications in magnetic and photovoltaic devices. [1] S. Fischer, A. Salcher, A. Kornowski, H. Weller, S. Förster, *Angew. Chem. Int. Ed*. **50** (2011) 7811.