AKB 80 Microfluidics

Zeit: Mittwoch 11:45–12:30 Raum: TU H2013

AKB 80.1 Mi 11:45 TU H2013

Experimental Proof of Absolute Negative Mobility of Single Brownian Particles — •Jan Regtmeier[1], Ralf Eichhorn[2], Peter Reimann[2], Dario Anselmetti[1], and Alexandra Ros[1] — [1]Experimentelle Biophysik und Angewandte Nanowissenschaften,Universität Bielefeld, Universitätsstr. 25,33615 Bielefeld — [2]Condensed Matter Theory,Universität Bielefeld,Universitätsstraße 25,33615 Bielefeld

Recently, it has been predicted theoretically [1] that the average motion of a single Brownian particle can be opposite to a small applied force. This behaviour, which seems to contradict Newtonian laws, is called Negative Mobility and can only occur far from thermodynamic equilibrium.

We experimentally demonstrate that negative mobility of non-interacting Brownian particles can be observed in periodic and symmetric potentials, forming a landscape of gaps and traps. Carboxylated polystyrene particles of 2 μm diameter in fact show an average motion against a static electric force in a poly(dimethylsiloxane) microfluidic device with micrometer sized periodically alternating structures using electrokinetic driving forces in physiological buffer solution. This setup enables high parallelisation and opens the way to use the system for biological applications such as separation of biomolecules or sorting of cells.

[1] R. Eichhorn, P. Reimann, P. Hänggi, Phys. Rev. Lett. 88, 190601 (2002)

AKB 80.2 Mi 12:00 TU H2013

Surface coating strategies for poly(dimethylsiloxane) microchannels — •Wibke Hellmich[1], Jan Regtmeier[1], Stephan Altmann[2], Dario Anselmetti[1], and Alexandra Ros[1] — [1]Experimental Biophysics and Applied Nanosciences, Physics Faculty, Bielefeld University — [2]BASF AG, Polymer Physics, Ludwigshafen

Control of the surface properties in microfluidic systems plays an important role for successful bioanalytical applications. Especially the unspecific interaction of apolar biomolecules with hydrophobic microchannel surfaces highly affects the analysis efficiency in poly(dimethylsiloxane) (PDMS) devices. Therefore, detailed knowledge and derivatisation strategies of the surface properties of PDMS microchannels are of great importance. In this work, coating strategies for poly(ethyleneoxide) (PEO) molecules of different chain lengths are presented for the control of the surface properties of PDMS.

Contact angle measurements as well as atomic force microscopy revealed homogenous immobilisation of covalently attached PEO silanes and adsorbed triblock-copolymer (F108) to the PDMS surface. For F108, two different adsorption mechanisms to PDMS for hydrophobic (untreated) and hydrophilic (oxygen plasma treated) surfaces were observed. PEO coated microchannels revealed significant reduction of the electroosmotic mobility depending on the PEO chain length. The application of these coatings for protein separations in PDMS microfluidic devices is currently under investigation.

AKB 80.3 Mi 12:15 TU H2013

Neue Anwendungen von magnetischen sphärischen Sub-Mikropartikel in Mikrofluidik-Chips — •Claus Fütterer[1], Nicolas Minc[1], Kevin Dorfman[1], Marcella Slovakova[1], Zuzana Bilkova[2] und Jean-Louis Viovy[1] — [1]Institut Curie, Paris — [2]Univ. Pardubice, Tschechische Republik

Wir benutzen magnetische spherische Mikro- und Nanopartikel, welche sich im homogenen B-Feld in einem Gitter anordnen, in Verbindung mit einem neuartigen Mikrofluidikkontrollsystem um die Separation langer DNA Moleküle semiquantitativ durchzuführen. Dadurch wird der Vergleich mit Monte-Carlo Modellen ermöglicht. Im gleichen System können auch Einzelmolekülexperimente durchgeführt werden, welche die Untersuchung des Separationsmechanismus ermöglichen.

Desweiteren wird ein wiederverwendbares Chip-System zur Proteinanalyse vorgestellt. Dort wird Verdauung und Konzentration von Proteinen und Proteinfragmenten auf einem Chip vereinigt. Die dazu benötigten Enzyme sind auf magnetische Nano-Partikel immobilisiert. Letztere werden durch ein inhomogenes Magnetfeld zurückgehalten und verdichtet. Die Formierung dieses Pfropfens zeigt ausserdem interessante physikalische Phänomene.