

Recenzja pracy doktorskiej Ladislava Derzsi, przedłożona do Rady Naukowej Instytutu Chemii Fizycznej PAN

Thesis:

Designing droplet microfluidic systems: from chemistry of surfaces, through rheological properties of fluids to geometries of the channels

submitted by PhD candidate:

Ladislav Derzsi

1. Objective

The thesis focuses on the methods to control the multiphase flow at the microscale. As the flow in microfluidic devices occurs at small length scales (usually sub-millimetres), surface stresses – including the interfacial tension effects, the shear stresses and elastic effects associated with deformations of the fluid – dominate over the inertial forces, which can typically be completely neglected. As a consequence the wettability of the walls of the channels, and of the interfacial tension between liquids are of outmost importance. In case of oils and polymer solutions the value of viscosity coefficient depends on shear stress what becomes crucial for the dynamics of microfluidic systems. These effects are profoundly discussed in the thesis, and a possibility to take advantage of non-Newtonian fluids behaviour to effectively modulate the flow has been demonstrated.

The aim of this thesis can be extracted from the introduction as the attempt to demonstrate possibility of controlling dynamics of multiphase microfluidic systems by applying:

- i) modification of the surface chemistry of the channels wall,
- ii) use of rheological effects of liquids used,
- iii) modifying geometry of the microchannels.

In the thesis the candidate presents (i) a new method of modification of the surface chemistry of microchannels fabricated in polycarbonate and the use of this