Experimental report

17/09/2018

Proposal: 9-11-1784 **Council:** 4/2016

Title: Collapse of entangled polymer brushes under shear

Research area: Soft condensed matter

This proposal is a continuation of 9-11-1745

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Samples: Silicon crystals

Instrument	Requested days	Allocated days	From	To
FIGARO	3	3	10/06/2016	13/06/2016

Abstract:

We have investigated a polystyrene brush grafted on a 7x7cm silicon slab, immersed in a free polystyrene solution and have measured the thickness of the brush by neutron reflectometry, as a function of an applied shear flow. Under shear, the brush stretches, which is entropically unfavourable and the chains prefer to collapse which reduces the interpenetration with the free flowing chains thus reducing drag force and the resulting sideways stretching.

Shear responsive surfaces offer potential advances in a number of applications. Surface functionalisation using polymer brushes is one route to such properties, particularly in the case of entangled polymers. We report on neutron reflectometry measurements of polymer brushes in entangled polymer solutions performed under controlled shear, as well as coarse-grained computer simulations corresponding to these interfaces. Here we show a reversible and reproducible collapse of the brushes, increasing with the shear rate. Using two brushes of greatly different chain lengths and grafting densities, we demonstrate that the dynamics responsible for the structural change of the brush are governed by the free chains in solution rather than the brush itself, within the range of parameters examined. The phenomenon of the brush collapse could find applications in the tailoring of nanosensors, and as a way to dynamically control surface friction and adhesion. Details can be found in the accompanying publication: *Macromolecules* **50**, 1215-1224 (2017).