Experimental Report

Proposal: **9-11-1623** **Council:** 10/2012

Title: Influence of the polymer topology on the formation of an interphase under confinement

This proposal is a new proposal

Researh Area: Physics

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Experimental Team: KRUTYEVA Margarita
BRAS Ana

Local Contact: SHARP Melissa

Samples: Poly(ethylene oxide)
Al2O3

Instrument	Req. Days	All. Days	From	To
IN15 Standard	10	7	27/05/2013	03/06/2013

Abstract:

We propose to study the dynamics of cyclic polymer chains (rings) confined in nanopores of anodic aluminium oxide (AAO). Based on our recent investigations of the dynamics of linear polymer melts confined in AAO nanopores revealing the formation of an interphase between the anchored chains and the bulk, we intend to elucidate the mechanism of interphase formation in confined systems. Polymer rings are ideal candidates for this key experiment.

We measured the dynamics of ring and linear polyethylene (oxide) (PEO) confined in Alumina nanopores. The molecular weight of the ring and linear polymer was about 5 and 4.6 kg/mol respectively that corresponds to approx. 2.5 entanglement lengths for the linear PEO. With this experiment we expected to study the interphase and chains adsorbed immediate at the surface ("interface").

The first part of the experiment (72 hours) was devoted to tuning of the instrument to measure the short time dynamical range. Dynamics measured on the picosecond time scale is important for the background estimation.

The neutron wavelengths 9 and 18 Å was used. Fourier times were varied from 16 ps to 300 ns.

The NSE results for the linear PEO are presented in the fig.1. It is obvious that the dynamics of linear chains are slowed down in confinement. At the same time, dynamics of linear PEO was found to be in agreement with our previous measurements [1].

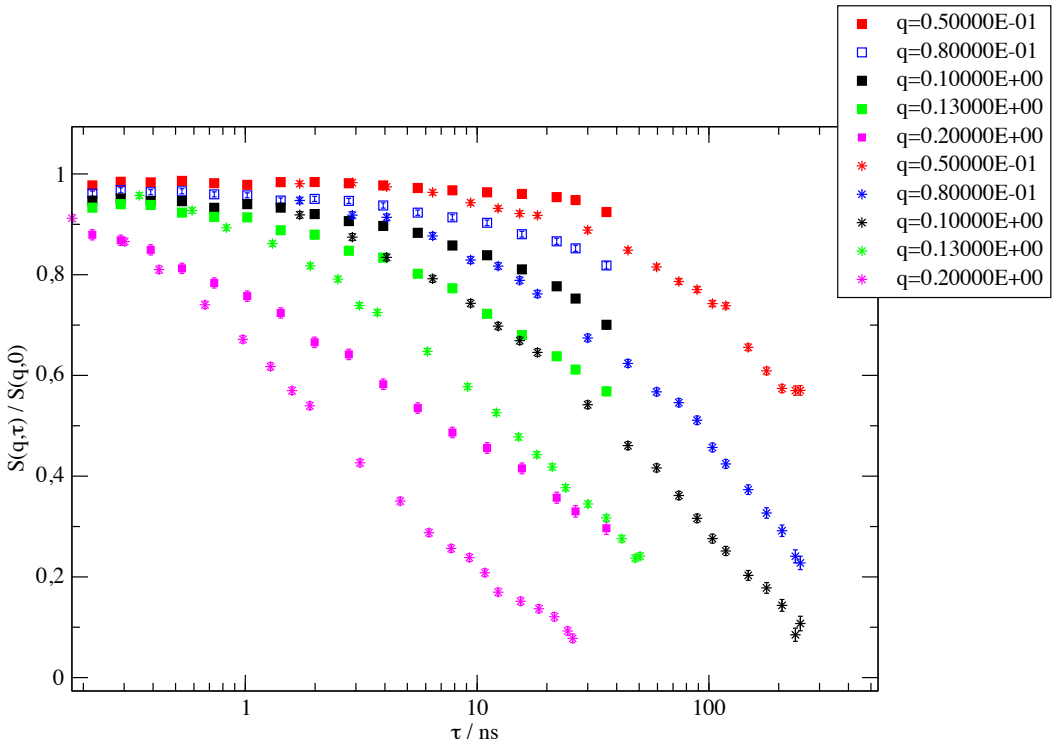

Fig. 1. NSE results for linear PEO confined in Alumina nanopores (squares) and pure PEO (stars) for different values of the momentum transfer Q from 0.05 to 0.2 $Å^{-1}$.

Similar to linear PEO, PEO rings demonstrate slowing down of dynamics in whole time and momentum transfer range (Fig.2).

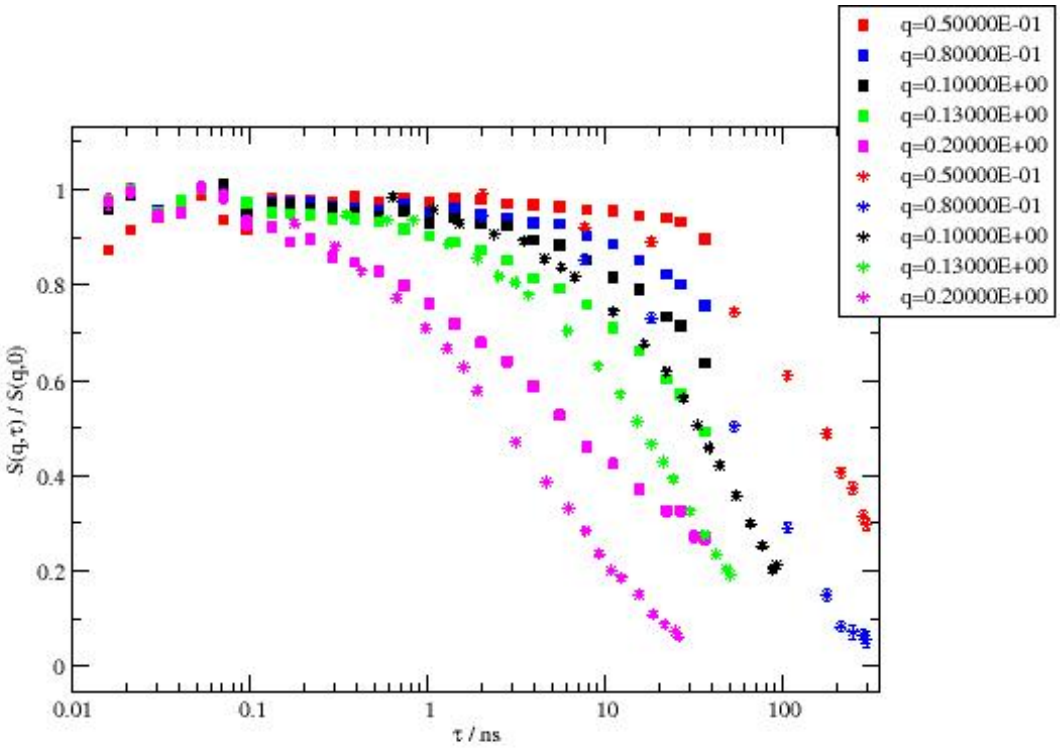

Fig.2 NSE results for PEO rings confined in Alumina nanopores (squares) and pure PEO rings (stars) for different values of the momentum transfer Q from 0.05 to 0.2 $Å^{-1}$.

At the same time we observed that the dynamics of rings and linear PEO in confinement is similar at least on the time scale up to 40 ns (Fig.3) that apparently evidence of larger confinement effect on the dynamics of the rings.

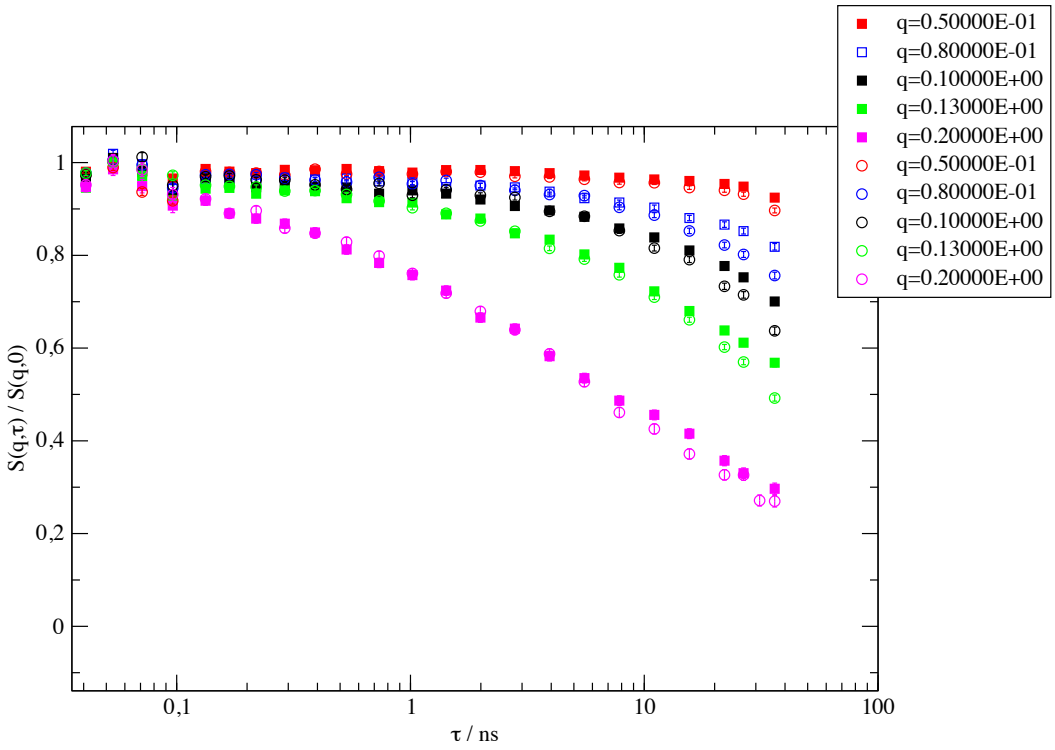

Fig.3 NSE results for PEO rings (circles) and linear (squares) confined in Alumina nanopores for different values of the momentum transfer Q from 0.05 to 0.2 $Å^{-1}$.

The treatment of the experimental data is still in progress.

[1] A. R. Bras et al., Soft Matter, **10**, 3649 (2014)