Experimental report

08/02/2018

Proposal: **INTER-361** **Council:** 10/2016

Title: Internal time on IN15

Research area:

This proposal is a new proposal

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Experimental team: Barbara BERKE
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Local contacts: Orsolya CZAKKEL

Samples: Heavy water D2O
poly(N-isopropyl acrylamide) (C6H11NO)n
graphene oxide (C2O)n
polymer gel composites

Instrument	Requested days	Allocated days	From	To
IN15	4	4	16/02/2017	20/02/2017

Abstract:

Experimental report – INTER-361

Experiment dates:16/02/2017-20/02/2017

Experiment team: Barbara Berke, Orsolya Czakkel

Local contact: Orsolya Czakkel. Péter Falus

INTRODUCTION

The aim of the experiment was to study the internal dynamics of carbon nanoparticle (CNP) filled soft gel systems based on poly(N-isopropyl acrylamide) (PNIPA). Such polymer gels exhibit a thermoresponsive behavior in which the matrix swells or deswells according to external stimuli. Our previous results showed that while the nature of the volume phase transition (VPT) is conserved the temperature response of the systems is strongly affected by incorporating CNPs.

EXPERIMENT

We investigated the dynamical behaviour of the nanocomposites at 40 °C, above their VPT. We used the IN15 high-resolution configuration with 10 Å wavelength incident neutron. A Lauda thermostat bath was used for precise temperature control of the samples.

Measurements were made at 4 different Q values in the range of 0.04-0.137 $Å^{-1}$.

We measured pure PNIPA gel, 5 and 20 mg/g NIPA graphene oxide (GO) and carbon nanotube (CNT) containing composites after one day and 42 days of thermalisation to compare the internal dynamics at different shrunk stages.

RESULTS

We found that the ISFs of the GO containing sample did not decrease significantly, which means that in the investigated time window the polymer chains cannot move. For the CNT containing sample slow movements were still found even after 42 days (Figure 1).

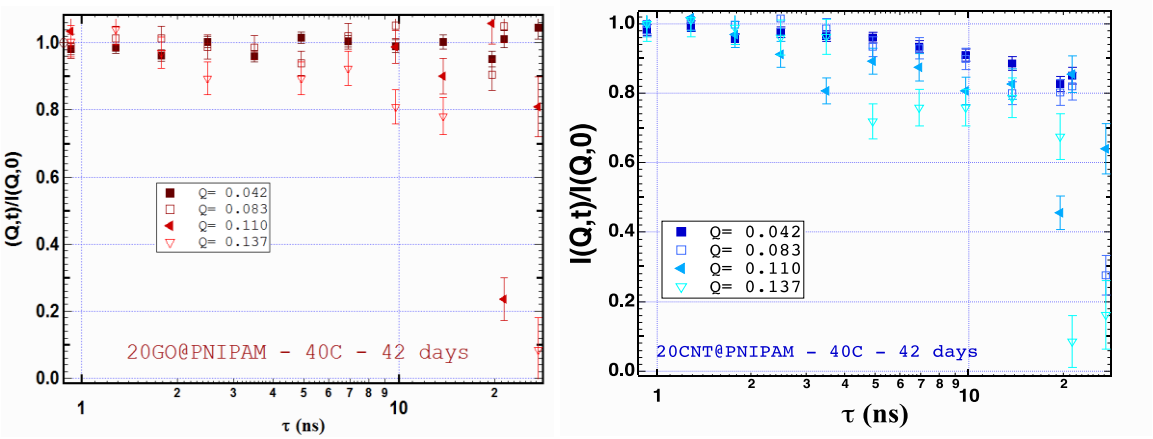

Figure 1: Corrected ISFs of 20GO@PNIPA150 and 20CNT@PNIPA150 at 40 ˚C after 42 days

IN15 gave us the possibility to measure on a longer time window as well, which can help determine the presence of frozen-in components after 1 day of thermalisation too (Figure 2).

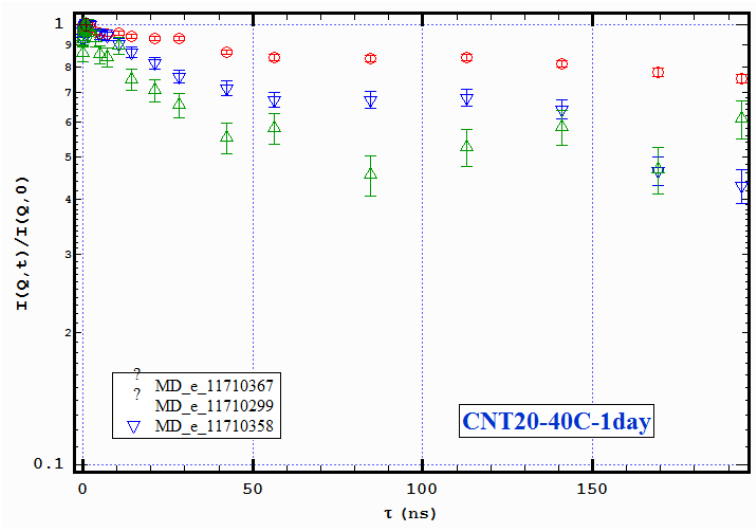

Figure 2: Corrected ISFs of 20CNT@PNIPA150 at 40 ˚C after 1 day