

Ηράκλειο,  
09/10/2019

## ΑΝΑΚΟΙΝΩΣΗ

### **ΠΑΡΟΥΣΙΑΣΗ ΔΙΠΛΩΜΑΤΙΚΗΣ ΕΡΓΑΣΙΑΣ**

Της Φοιτήτριας **Αικατερίνης - Ζωής Πεπονάκη**, θα γίνει  
την

**Τρίτη 15/10/2019** και ώρα **13:00**

στην αίθουσα A210 του Κτιρίου Μαθηματικών και  
Εφαρμοσμένων Μαθηματικών.

**Θέμα Διπλωματικής:**

**«Shear Rheology of Unentangled Bottlebrush  
Polystyrenes»**

#### **Περίληψη**

This thesis is an effort to shed light on the dynamical behavior of polymers with complex architectures and especially bottlebrushes. These materials have become an active research area due to advancements in controlled polymerization techniques that enable facile synthesis with well-defined molecular dimensions, as well as their tunable rheology at molecular scale.

Bottlebrush polymers are a type of branched polymer with a large number of polymeric side-chains attached to a linear backbone. Typically, every backbone monomer is grafted. Because of this, their radius is considerably smaller than their linear analogues of similar molecular weight. Additionally, they have other unique properties such as their larger effective persistence length which results in fewer entanglements and the fact that they exhibit much different relaxation spectra resulting in different dynamics. Their conformational and

physical properties are governed by two important molecular parameters: 1) the grafting density and 2) the degree of polymerization of the backbone and of the side chains. Furthermore, bottlebrushes can be thought of as “thick polymers” with extremely very low plateau modulus, alternatively large entanglement molecular weight, hence they are easily processable.

Here, we characterize a well-characterized series of bottlebrush polystyrenes with molar masses ranging from 132-769 kg/mol bearing short side chains having molar masses 5 and 7 kg/mol, which are shorter than the entanglement molecular weight of linear polystyrene. We present and analyze their linear rheological behavior. We show that these polymers adopt cylindrical conformation with extended side chains and stretched backbone due to their grafting density which is the maximum possible. The master curves of these polymer have been constructed by time-temperature superposition featuring sequential relaxation and an absence of rubbery plateau. The scaling behavior of the master curves reveals Zimm-like dynamics at early relaxation times that become Rouse-like at long relaxation times.

To date, the underlying dynamics of graft architectures and in particular the transition from combs to bottlebrush polymers is still not fully established. Thus, with our experimental work we aim to translate the dynamics of bottlebrush polymers into models, in order to be able to describe and predict their associated physical properties.