

第265回

物質科学セミナー

題名：Unraveling the complex polymorphic crystallization behavior of the alternating copolymer DMDS-*alt*-DVE

講師：Alejandro J. Müller 氏
(University of the Basque Country UPV/EHU,
Basque Foundation for Science, Spain)

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講演要旨：

Recently, a complex crystallization behavior was observed for the alternating copolymer DMDS-*alt*-DVE synthesized via thiol-ene step-growth polymerization between 2,2'-dimercaptodiethyl sulfide (DMDS) and a diene di(ethylene glycol) divinyl ether (DVE). Understanding the underlying complex crystallization processes of such novel polythioethers is critical for their application, for example, in polymer coating technologies. These alternating copolymers have polymorphic traits, resulting in different phases that may display distinct crystalline structures. The copolymer DMDS-*alt*-DVE was already shown to exhibit two crystalline phases (a low melting phase, denoted as $L - T_m$, and a higher melting phase, denoted as $H - T_m$). Remarkably, in thin films, the $H - T_m$ form was only achieved by the previous formation and melting of the $L - T_m$ form. To explore the kinetics of this unusual and complex polymorphic behavior in further detail in larger samples and for a broader range of thermal protocols, we applied calorimetric techniques encompassing seven orders of magnitude in scanning rates. Most importantly, by rapidly quenching the sample to temperatures well below room temperature, we detected an additional polymorphic form (characterized by a very low melting phase, denoted $VL - T_m$). Furthermore, by appropriately tailored thermal protocols, we were able to predict which of the three polymorphs could be established, allowing us to produce samples that contain only one, two, or all three forms. Understanding the interrelationships between polymorphism, crystallization, and the resulting morphological differences has a potential impact on mechanical resistance and barrier properties.

理工学融合共同演習の認定科目です。

世話人：長谷川巧 (内 6545)