Extensional rheology and final morphology of polymeric fibers

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The morphology of polymeric products is highly dependent on the deformation history during processing. In processes like fiber spinning, blow moulding etc. the material undergoes extensional deformation. Due to instrumental limitations the number of studies investigating the influence of extensional flows on crystallization is very limited relative to the number of studies on shear induced crystallization. In this study we investigate the coupling between extensional flow dynamics and crystallinity of various linear polymeric systems. The investigated systems all contain a high molar mass fraction also known as a high molecular weight tail. It is known from shear induced crystallization studies, that presence of such a tail changes the flow-induced morphology significantly. That is, even if the fraction is so small that it is undetectable using standard characterization methods (*1*). The interesting aspect of investigating such systems in extension is that, inherently extensional rheology is highly sensitive to the presence of a high molar mass fraction, that also seems to govern the crystallinity (*2*). Indeed we find that the extensional response reveals the conformational evolution of the high molar mass fraction and is directly correlated with the final morphology.

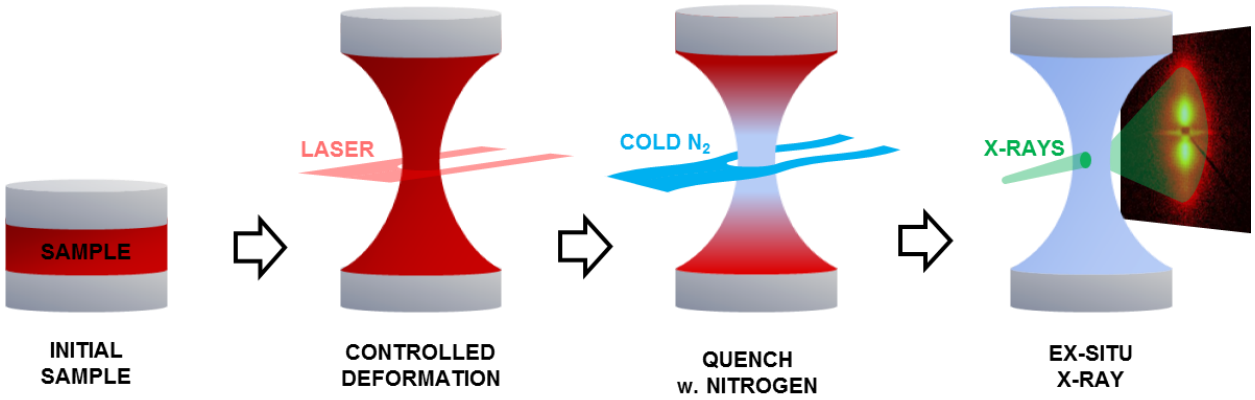

Figure 1: Experimental protocol for studying the correlation between extensional rheology and final morphology of polymeric fibers.

References

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