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**Small Angle Neutron Scattering Study in Multi-Component Polymer Systems: Spinodal Decomposition and Beyond**

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Institute for Advanced Study, Shenzhen University, Shenzhen, China In memory of Professor John Kohn at this symposium, a time resolved SANS study for the early stage of spinodal decomposition kinetics of deuterated polycarbonate/poly(methylmethacrylate) blend will be reviewed which gives a clear proof of the Cahn-Hillard-Cook theory. This early stage of spinodal decomposition kinetics has been observed starting from the dimension $(q^{-1})$ comparable to the single chain radius of gyration, $R_g$, for a binary polymer mixture. The results provide an unequivocal quantitative measure of the virtual structure factor, $S(q, \infty)$; the relationship of $q_m$ and $q_c$ through rate of growth, Cahn-plot analysis, and singularity in $S(q, \infty)$; the growth of fluctuation of $qR_g < 1$ and intra-chain relaxation of $qR_g > 1$. More recent study of using mixed suspensions of polystyrene microspheres and poly(N-isopropylacrylamide) microgels as a molecular model system which has a long range repulsive interaction potential and a short range attractive potential, will also be discussed. In this model system, dynamic gelation, transition to soft glass state and cross-over to hard glass state will be demonstrated and compared with available theories for glass transition in structural materials. Acknowledgements go to: Polymers Division, and NCNR of NIST, and to ICCAS, Beijing, China. Also to my colleagues: M. Motowoka, H. Jinnai, T. Hashimoto, G.C. Yuan and H. Cheng