



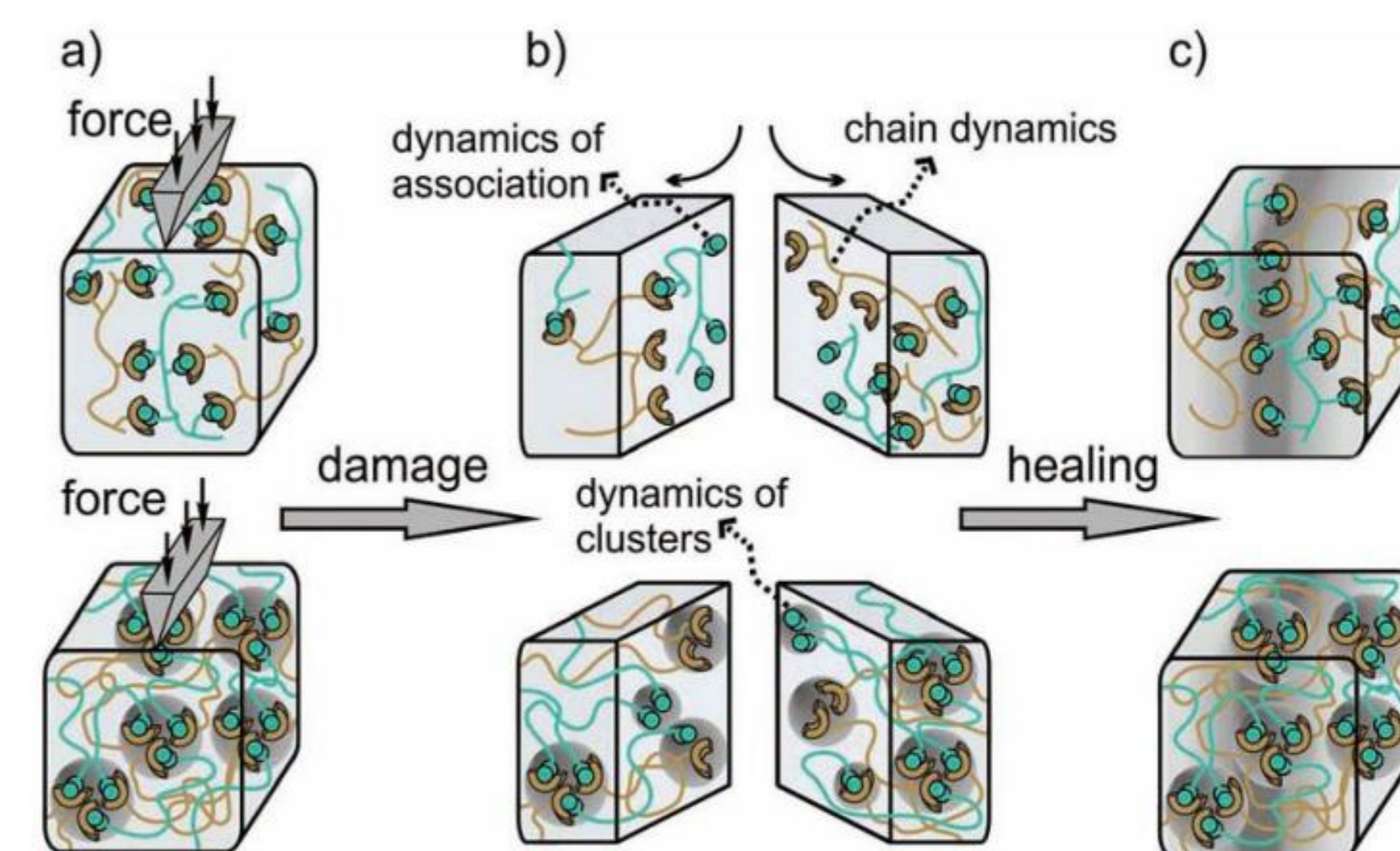
Rheology study of hybrid cross-linking network with both covalent bonding and non-covalent bonding in NBR

Jie Yang, Yonggang Shangguan*

•MOE Key Laboratory of Macromolecular Synthesis and Functionalization, Department of Polymer Science and Engineering, Zhejiang University, Hangzhou 310027, China

Abstract

A hybrid cross-linking network in rubber with covalent bonding cross-linkers and non-covalent bonding cross-linkers was established through radical polymerization in melt. Dicumyl peroxide (DCP) was used as chemical cross-linking agent and initiator to functionalize N,N-methylenebis acrylamide(MBA) onto rubber chains. The influence of the content of DCP and MBA on density of cross-linkers had been investigated through swelling equilibrium. Dynamic mechanical analysis(DMA) and rheology study indicated that samples with more non-covalent cross-linkers were more sensitive to deformation and temperature. The γ_c of samples decreased with the increasing content of MBA and increased as temperature rises.



Result

Swelling equilibrium

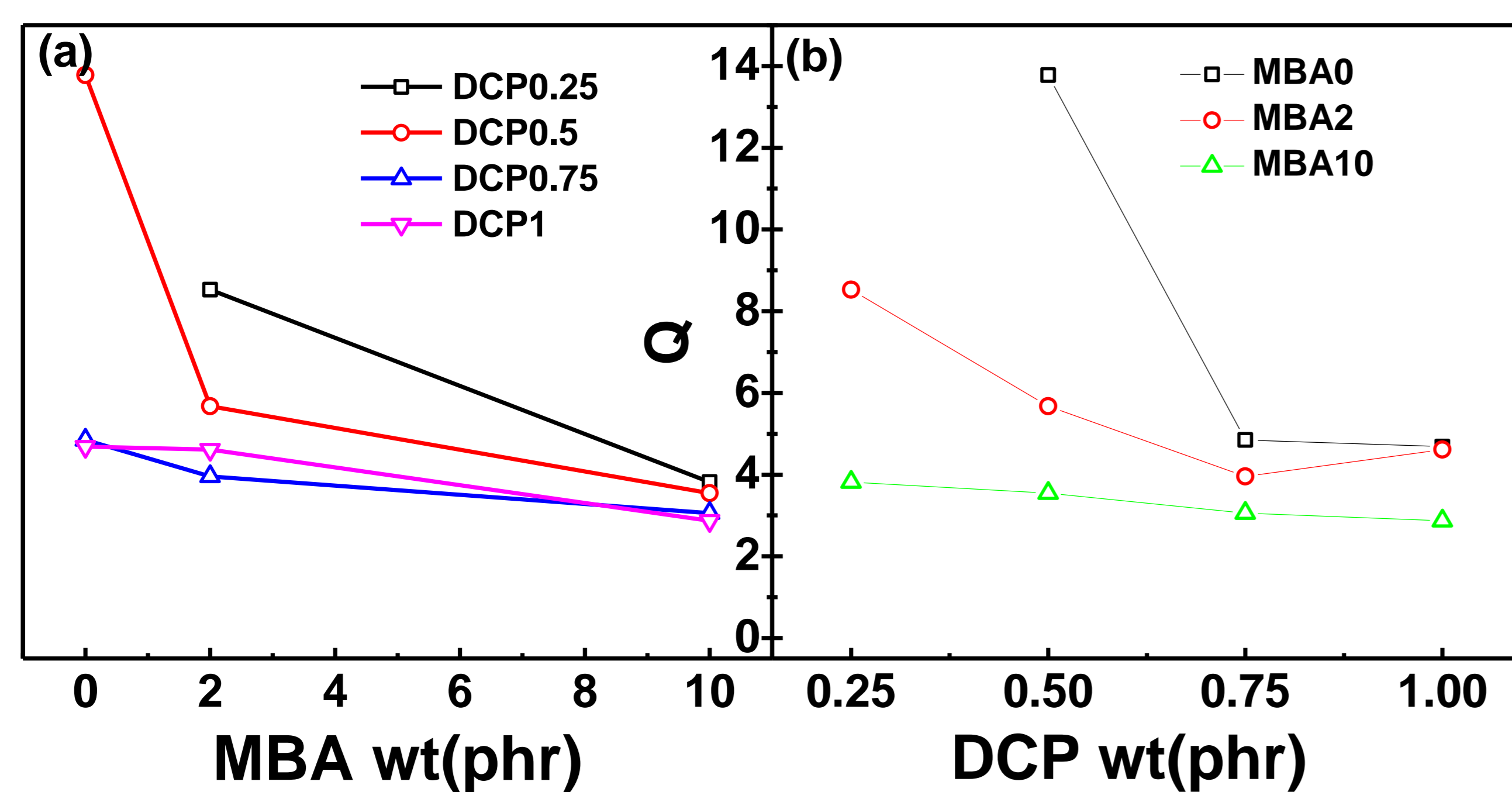


Figure 1 The swelling degree of samples in acetone at room temperature

Rheological behaviors

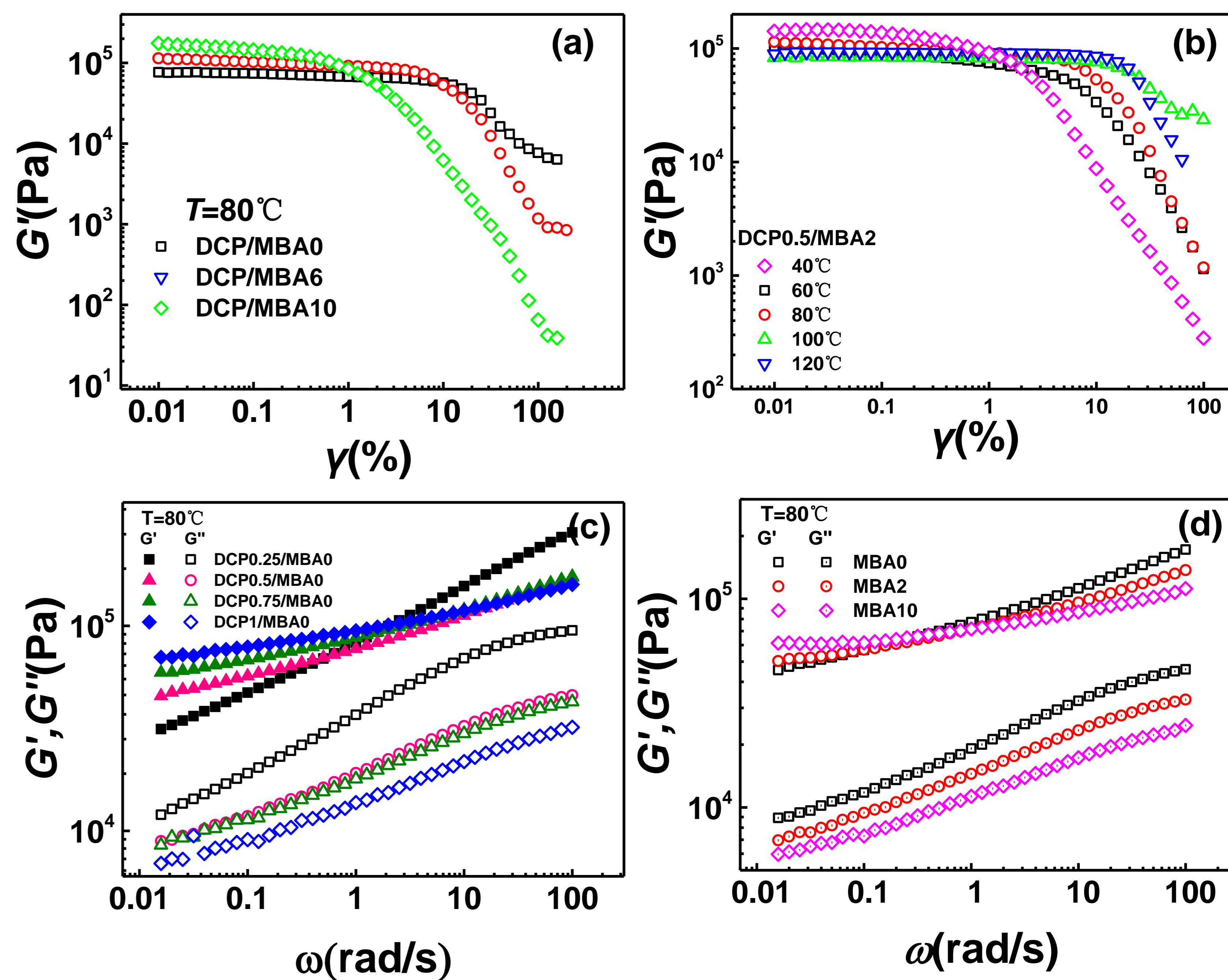


Figure 4 The strain sweep of samples with 0.5phr DCP at 80°C(a); strain sweep of DCP0.5/MBA2 at different temperature(b); frequency sweep of samples with different content of DCP at 80°C (c); frequency sweep of samples with 0.5phr DCP at 80°C(d)

Mechanical Properties and Dynamic Mechanical Analyses

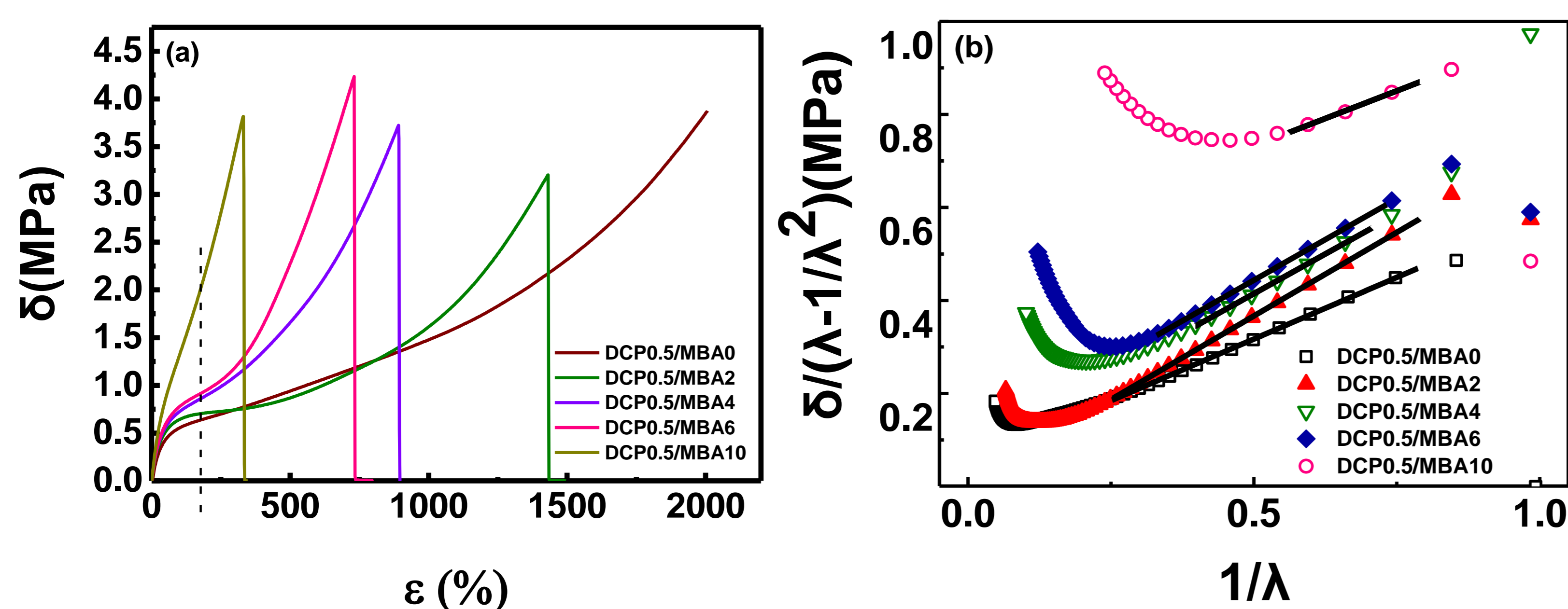


Figure 2 Typical stress-strain curves of samples(a) and reduced stress-strain curves based on Mooney-Rivlin equation(b)

sample	$2C_1$
DCP0.5/MBA0	0.05
DCP0.5/MBA2	0.01
DCP0.5/MBA4	0.07
DCP0.5/MBA6	0.09
DCP0.5/MBA10	0.49

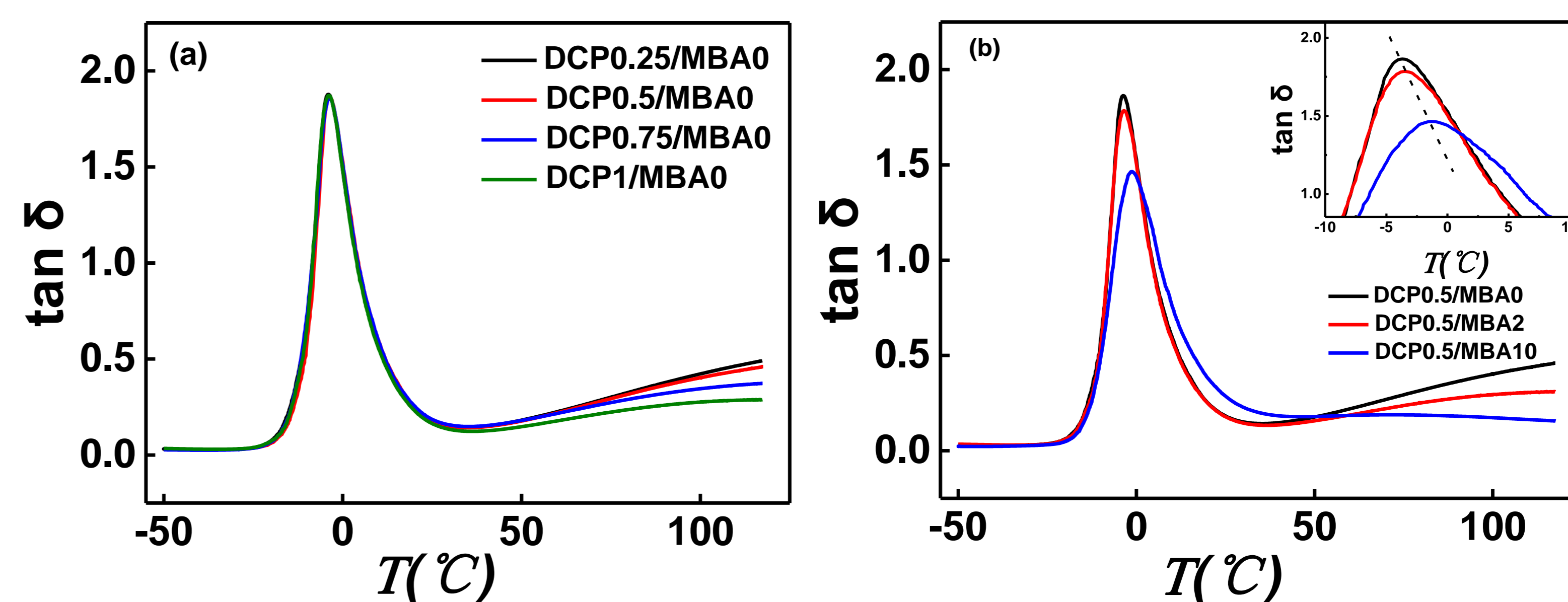


Figure 3 Tan δ of samples with 0phr MBA (a) and 0.5phr DCP (b) obtained from DMA

Contact Information

Dr. Shangguan YG, Professor
Department of Polymer Science and Engineering
Zhejiang University, Hangzhou, 310027
shangguan@zju.edu.cn

References

- [1] F. He, D. Do, et al. Macromolecular rapid communications, 2013, 34(3): 203-220.
- [2] F. Herbst, S. Seiffert, W. H. Binder, Polym. Chem. 2012, 3, 3084
- [3] Li Y, Yao Z, Chen Z, et al. Industrial & Engineering Chemistry Research, 2013, 52(23): 7758-7767.