Preparation of Multicomponent LIPNs and Its Miscibility and Damping Behaviors

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Abstract: A series of multicomponent latex interpenetrating polymer networks (LIPNs) were synthesized by the two-stage emulsion polymerization method. The influence of the composition ratio of network I and network II, types and dosages of crosslinker on miscibility and damping properties of the multicomponent LIPNs were investigated with an rheovibron viscoelastometer. The results show that the miscibility and damping properties of the LIPNs are very sensitive to such factors as composition ratio of monomer I and monomer II, types and contents of crosslinker etc. Both miscibility and damping properties of multicomponent LIPNs are optimum at LIPN of P(MMA-EMA)/P(EA-nBA) = 46/60, where MMA/EMA = 70/30 in network I and EA/nBA = 50/50 in network II.

Key words: latex interpenetrating polymer networks; damping properties; miscibility
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IPNs have been used as damping materials for sound and vibration for many years[1-4]. We synthesized and investigated a series of multi component LIPNs base on different monomers and crosslinkers.

1 Experimental

The LIPNs were synthesized by a two-stage emulsion polymerization. A Rheometrics RDA2 at 35 Hz was used for temperature scans at 2 ℃/min.

2 Results and Discussion

2.1 Influence of composition of network I

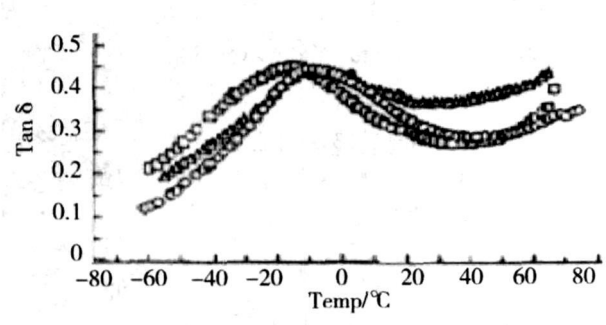

Fig. 1 Influence of composition of network I on damping properties. ○ - A-1 St/MMA/EMA = 60/40/0; □ - A-2 St/MMA/EMA = 70/0/30; Δ - A-1 St/MMA/EMA = 0/70/30

It can be seen from Figure 1 that damping property of the LIPN is optimum as the ratios of MMA/EMA = 70/30 in network I and network I/network II = 40/60. It means that the miscibility of system A-3 is the best, A-1 the second and A-2 the worst.

2.2 Influence of monomer VAc in network II

Figure 2 and Figure 3 show that the damping properties of LIPNs with VAc are inferior to that of LIPNs without VAc.

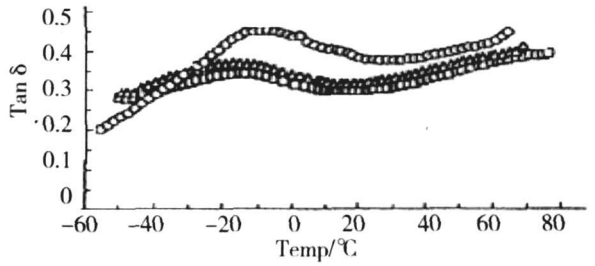

Fig. 2 Influence of network II on damping prop ○ - EA/VAc/nBA = 50/0/50; □ - EA/VAc/nBA = 25/15/60; Δ - EA/VAc/nBA = 30/10/60.

2.3 Influence of the ratio of network I to network II

Figure 4 indicated that the influence of network II on glass transition of network I is not very clear. The damping properties of LIPNs are dependent strongly to the composition and content of network II.

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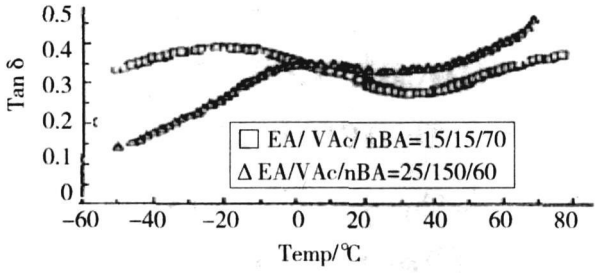

Fig. 3 Influence of VAc dosage on damping properties

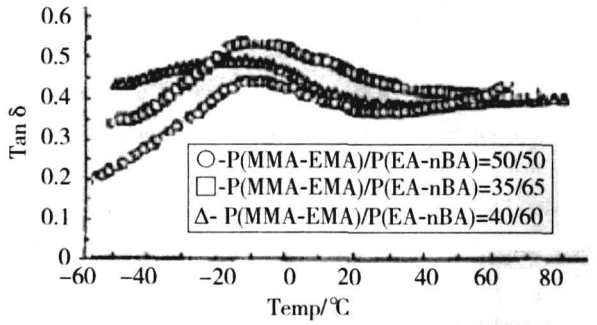

Fig. 4 Influence of the ratio of network I to network II on damping properties

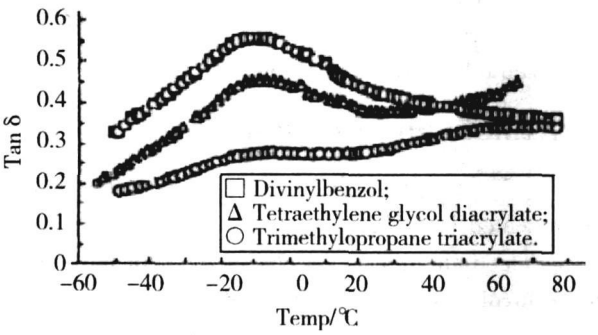

Fig. 5 Influence of crosslinker on damping properties

2.4 Influence of crosslinker type and content

Figure 5 and Figure 6 noted that the influence of different crosslinkers on miscibility and damping properties of the LIPNs are much varied at same dosages.

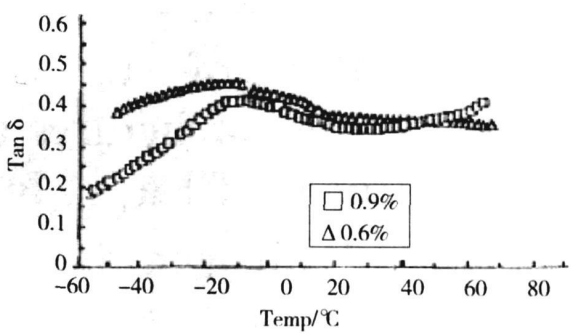

Fig. 6 Influence of crosslinker on damping properties

3 Conclusion

The miscibility and damping properties of the LIPNs are very sensitive to such factors as composition ratio of network I and network II, types and dosages of crosslinker etc. Both miscibility and damping behavior of multicomponent LIPNs are optimum at LIPN of P(MMA-EMA)/P(EA-nBA) = 40/60, where MMA/EMA=70/30 in network I and EA/nBA=50/50 in network II.

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多组分 LIPN的制备及相容性和阻尼性能

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摘　要：采用两步法合成了一系列多组分乳液 IPN，借用动态粘弹谱仪研究体系组成、网络 I与网络II的配比、交联剂的品种和用量对 LIPNs体系相容性和阻尼性能的影响。结果表明：LIPNs的相容性和阻尼性能对体系组成、网络配比、交联剂种类及用量均非常敏感。当网络 I为 MMA/EMA=70/30，网络II为 EA/nBA=50/50，网络 I/网络II为 P(MMA-EMA)/P(EA-nBA) =40/60时，体系的相容性及阻尼性能最佳。

关键词：相容性；阻尼性能；网络配比；组成

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