

## The Effect of Ingredients Mixing Sequence in Rubber Compounding on the Formation of Bound Rubber and Cross-Link Density of Natural Rubber

**Authors :** Abu Hasan, Rochmadi, Hary Sulisty, Suharto Honggokusumo

**Abstract :** This research purpose is to study the effect of Ingredients mixing sequence in rubber compounding onto the formation of bound rubber and cross link density of natural rubber and also the relationship of bound rubber and cross link density. Analysis of bound rubber formation of rubber compound and cross link density of rubber vulcanizates were carried out on a natural rubber formula having masticated and mixing, followed by curing. There were four methods of mixing and each mixing process was followed by four mixing sequence methods of carbon black into the rubber. In the first method of mixing sequence, rubber was masticated for 5 min and then rubber chemicals and carbon black N 330 were added simultaneously. In the second one, rubber was masticated for 1 min and followed by addition of rubber chemicals and carbon black N 330 simultaneously using the different method of mixing then the first one. In the third one, carbon black N 660 was used for the same mixing procedure of the second one, and in the last one, rubber was masticated for 3 min, carbon black N 330 and rubber chemicals were added subsequently. The addition of rubber chemicals and carbon black into masticated rubber was distinguished by the sequence and time allocated for each mixing process. Carbon black was added into two stages. In the first stage, 10 phr was added first and the remaining 40 phr was added later along with oil. In the second one to the fourth one, the addition of carbon black in the first and the second stage was added in the phr ratio 20:30, 30:20, and 40:10. The results showed that the ingredients mixing process influenced bound rubber formation and cross link density. In the three methods of mixing, the bound rubber formation was proportional with crosslink density. In contrast in the fourth one, bound rubber formation and cross link density had contradictive relation. Regardless of the mixing method operated, bound rubber had non linear relationship with cross link density. The high cross link density was formed when low bound rubber formation. The cross link density became constant at high bound rubber content.

**Keywords :** bound-rubber, cross-link density, natural rubber, rubber mixing process

**Conference Title :** ICPMSE 2014 : International Conference on Polymer Materials Science and Engineering

**Conference Location :** Venice, Italy

**Conference Dates :** November 13-14, 2014