Proceedings of the World Congress on New Technologies (NewTech 2015)
Barcelona, Spain – July 15 - 17, 2015
Paper No. 413

Interfacial Adhesion between Ethylene-Propylene-Diene-Termonomer and Fluoroelastomer

JunYeol Jang, Seung Gyeom Kim, Changwoon Nah
BK21 Plus Haptic Polymer Composite Research Team, Department of Polymer-Nano Science and Technology, Chonbuk National University, Jeonju 561-756, Republic of Korea
zgmfxzza@naver.com; fsteruda@naver.com; cnah@jbnu.ac.kr

Byeong-Heon Jeong, Bo Ki Hong
Fuel Cell Vehicle Team 1, R&D Division
Hyundai Motor Group, Yong-in 446-912, Republic of Korea
tiger777@hyundai.com; boki.hong@hyundai-motor.com

Extended Abstract

The adhesion that occurs at the interface of two rubbers depends not only on the surface energy but also the degree of physical or chemical crosslinking at interface. It is known that autohesion of elastomers depends on interfacial diffusion and molecular interlocking. Yet, in case of adhesion of two different rubbers crosslinked at different degrees, it is difficult to analyze the type of bonds involved and the fracture behavior at the interface of the bonded rubbers.

This paper describes the adhesion behaviors of carbon black-filled elastomers with their respective partially-cured counterparts having different degrees of crosslinking. Ethylene-propylene-diene-termonomer (EPDM) and fluoroelastomer (FKM) were explored as the elastomer matrices. The adhesion test was conducted by attaching the partially-cured sheet to the fully-cured elastomer sheet with the aid of a peel test. As expected, the adhesive strength was found to increase as the degree of crosslinking decreases. A correlation between the adhesive fracture energy, G_a and the cohesive strength (tear strength in this study), G_c were also investigated. It was found that the G_a of EPDM sheets was much lower than the corresponding G_c of a fully-cured EPDM sheet. However, both the G_a and G_c of the FKM rubber were more or less the same. Our most interesting observation is that a considerable adhesive strength exists between the fully-cured FKM sheets even after post curing, while the fully-cured EPDM sheets show no adhesive strength. The abnormal behavior for the FKM sheets might be responsible for the electrostatic attraction between hydrogen and fluorine present in FKM elastomer.

Chang, R.J., & Gent, A.N. (1981). Effect of Interfacial Bonding On Strength of Adhesion of Elastomers. I. Self-Adhesion. *J. Polym. Sci. Polym. Phys. Ed.*, *19*, 1619.

Chang, R.J., & Gent, A.N. (1981). Effect of Interfacial Bonding On Strength of Adhesion of Elastomers. II. Self-Adhesion. *J. Polym. Sci. Polym. Phys. Ed.*, *19*, 1635.

Choi, S.S., & Kim, O.B. (2011). Influence of Inorganic Filler on Properties of EPDM Compounds. *Elast. Compos.*, *46*, 138.

Choi, S.S., Hwang, K.J., & Kim, B.T. (2005). Influence Of Bound Polymer On Cure Characteristics Of Natural Rubber Compounds Reinforced With Different Types Of Carbon Blacks. *J. Appl. Polym. Sci.*, *98*, 2282.

Choi, S.S., Park, B.H., & Song, H. (2004). Influence Of Filler Type And Content On Properties Of Styrene-Butadiene Rubber(SBR) Compound Reinforced With Carbon Black Or Silica. *Polym. Adv. Technol.*, *15*, 122.

DaCosta, H.M., Visconte, L.L.Y., Nunes, R.C.R., & Furtado, C.R.G. (2002). Mechanical and Dynamic Mechanical Properties of Rice Husk Ash-Filled Natural Rubber Compounds. *J. Appl. Polym. Sci.*, *83*, 2331.

Gent, A.N. (1982). The Role of Chemical Bonding in the Adhesion of Elastomers. *Rubber Chem. Technol.*, *55*, 525.

Gent, A.N., & Kim, H.J. (1978). Tear Strength of Stretched Rubber. *Rubber Chem. Technol.*, *51*, 35.

Gent, A.N., & Lai, S.M. (1994). Interfacial Bonding, Energy Dissipation, and Adhesion. *J. Polym. Sci. Polym. Phys. Ed.*, *32*, 1543.

Gent, A.N., & Lai, S.M. (1995). Adhesion and Autohesion of Rubber Compounds:Effect of Surface Roughness. *Rubber Chem. Technol.*, *68*, 13.

Ko, M.B., & Kim, J.K. (1999). Clay-Dispersed Polymer Nanocomposites. *Polym. Sci. Tech. (Korea)*, *10*, 451.

Medalia, A.I. (1987). Effect of Carbon Black on Ultimate Properties of Rubber Vulcanizates. *Rubber Chem. Technol.*, *60*, 45

Nah, C., & Kaang, S.Y. (1997). Rheological and Mechanical Properties of Styrene-Butadiene Rubber Compounds. *J. Polym. Eng.*, *17*, 323.

Nah, C., Kim, H.J. (1997). Effect of Loading and Particle Size of Rubber Powder Vulcanizate on Physical Properties of Natural Rubber Compound. *Polymer-Korea*, *21*, 648.

Nah, C., Kim, H.J., Kaang, S.Y. (1998). A Study of the Effect on Degree of Cure on the Physical Properties of Rubber Compounds. *Elast. Compos.*, *33*, 281.

Nah, C., Rhee, J.M., Lee, J.H., Kaang, S.Y. (2001). Adhesion Strength and Fracture Behavior between Carbon Black-Filled Rubber Sheets. *J. Adhes. Sci. Technol.*, *15*, 583.

Radhakrishnan, C.K., Sujith, A., & Unnikrishnan, G. (2007). Thermal Behaviour of Styrene Butadiene Rubber/Poly (Ethylene-Co-Vinyl Acetate) Blends. *J. Therm. Anal. Calorim.*, *90*, 191.

Zheng, H., Zhang, Y., Peng, Z., & Zhang, Y. (2004). Influence of Clay Modification on the Structure and Mechanical Properties of EPDM/Montmorillonite Nanocomposites. *Polym. Test*, *23*, 217.