MATERIAL BEHAVIOR OF CARBOXYLATED NITRILE BUTADIENE RUBBER (XNBR) IN DEPENDENCE ON CROSSLINKER AND MEDIUM

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The ionomer carboxylated nitrile butadiene rubber (XNBR) comprises carboxylic groups which enable the formation of ionic bonds. It was observed in previous work that ionic bonds can aggregate to form multiplets acting as large crosslink points. Both monovalent and multivalent ions are capable of multiplet formation, leading to ionic bonds with excellent strength and hardness [1]. As these bonds are not stable at elevated temperature, additional covalent crosslinks have to be introduced to improve the high-temperature performance [2]. This study aims at analyzing the effect of crosslinker type on mechanical and physical properties of dipped XNBR latex films. The films were characterized by tensile tests and stress-rupture tests to assess the fracture behavior.

Along with the network structure, the influence of selected media on the mechanical performance of the crosslinked XNBR films was investigated. The diffusion of molecules from the liquid into the elastomeric network leads to swelling and results in material softening [3]. The crosslink structure highly influences the swelling degree. In the present work, XNBR latex films comprising different crosslinkers were immersed in deionized water and subsequently analyzed (e.g. swelling degree and mechanical properties). It was shown that ionic bonds are sufficient to achieve excellent mechanical properties in original, unimmersed state whereas additional covalent bonds are required to increase the stress-rupture behavior in swollen state. The initial tensile strengths were recovered or even exceeded upon water removal.

[1] Kells A., Groves B. (2006): Crosslinking in carboxylated nitrile rubber dipped films. Latex, 24-25 January 2006, Frankfurt, Germany.

[2] Ibarra L., Alzorriz M. (2002): Ionic elastomers based on carboxylated nitrile rubber (XNBR) and zinc peroxide: Influence of carboxylic group content on properties. J. Appl. Polym. Sci. 84(3), 605-615.

[3] Callister W. D., Rethwisch D. G. (2010): Materials science and engineering. An introduction (8th edition, p. 707). New York, US: John Wiley & Sons, Inc.