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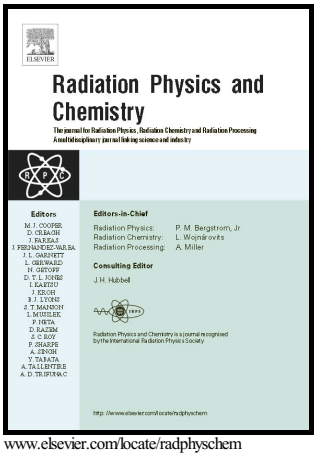

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PII: S0969-806X(17)30969-6
DOI: https://doi.org/10.1016/j.radphyschem.2017.12.011
Reference: RPC7717

To appear in: *Radiation Physics and Chemistry*

Received date: 13 September 2017
Revised date: 10 December 2017
Accepted date: 14 December 2017

Cite this article as: Katarzyna S. Bandzierz, Louis A.E.M. Reuvekamp, Grażyna Przybytniak, Wilma K. Dierkes, Anke Blume and Dariusz M. Bieliński, Effect of electron beam irradiation on structure and properties of styrene-butadiene rubber, *Radiation Physics and Chemistry,* https://doi.org/10.1016/j.radphyschem.2017.12.011

Effect of electron beam irradiation on structure and properties of styrene-butadiene rubber

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Abstract

Crosslinking and chain scission occur simultaneously during irradiation of polymers and influence their properties in an opposite way. To characterize the radiation-induced changes and evaluate how they influence the performance of the polymer, quantification of these reactions is crucial. In this work, the effect of styrene-butadiene rubber (SBR) radiation curing with doses ranging from 25 kGy to 200 kGy, at room temperature and air atmosphere was investigated. The Charlesby-Pinner and Charlesby-Rosiak equations were used to characterize the curing process. Only the Charlesby-Rosiak equation gave good linear representation of the data and allowed to obtain the parameters, which characterize the irradiated SBR system: (i) gel dose, (ii) ratio between chain scission and crosslinking, and (iii) radiation yields of crosslinking and chain scission. These parameters showed that SBR is quite resistant to ionizing radiation, where crosslinking predominates over chain scission. The effect of irradiation on in-rubber properties is discussed. An increase in radiation dose resulted in change of tensile strength, elongation at break, mechanical modules, hardness, glass transition temperature and thermo-oxidative stability. Freezing point depression experiments were also conducted. The depression of the solvent freezing temperature in swollen polymer gels provided information on polymer network and mesh size, staying in agreement with the crosslink density values.

Keywords

styrene-butadiene rubber, radiation curing, crosslinking, chain scission, degradation, freezing point depression