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Describing strain behavior of cross-linked elastomers under stretching with constant rate

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Abstract

The strain behavior of cross-linked elastomers under stretching with a constant rate was investigated. The stress versus strain dependence can be described using an approach, taking into account high-elastic properties of elastomers and relaxation properties too. Changes in elastic properties of relaxation elements during stretching were taking into account by transformation function. Investigation of interrelation between this function and parameters reflecting finite extensibility of polymer chains provided a system of equations describing stress versus strain relations for elastomers with hardening effect in a wide diapason of stretching rate. The approach was tested on a series of polyetheruretane elastomers with different values of the chemical network density.

References

[1] A. Tobolsky. Structute and properties of polymers. *M: Khimiya.* **1964**. 322p. (russian)
[2] V.V. Tereshatov, V.Yu. Senichev. Stress-Strain Dependence of Cross-Linked Single-Phase Polyether Urethane. *Journal of Macromolecular Science, Part B: Physics*. **2014**. Vol.53. P.575-587. (russian)
[3] M.C. Boyce, E.M. Arruda. Swelling and mechanical stretching of elastomeric materials. *Mathematics and Mechanics of Solids*. **2001**. Vol.6. P.641-659.
[4] V.V. Tereshatov, V.Y. Senichev. Stress-strain behavior of cross-linked polybutadiene urethanes. *Vysokomolekulyarnye Soedineniya Seriya A & Seriya B.* **1995**. Vol.37. P.1166-1169. (russian)
[5] V.V. Tereshatov, V.Y. Senichev. The effect of low-molecular liquids on physical network and viscoelastic properties of cross-linked amorphous polydieneurethanes. *Vysokomolekulyarnye Soedineniya Seriya A & Seriya B.* **1995**. Vol.37. P.1888-1895. (russian)
[6] V.V. Tereshatov, V.Yu. Senichev. Stress–Strain Dependence of Segmented Polyurethanes and Polyurethane Ureas. *Journal of Macromolecular Science, Part B: Physics*. **2015**. Vol.54. P.365-380. (russian)
[7] B. Erman, L. Monnerie. Theory of elasticity of amorphous networks: effect of constraints along chains. *Macromolecules*. **1989**. Vol.22. P.3342-3348. (russian)
[8] C.O. Horgan, G. Saccomandi. Finite thermoelasticity with limiting chain extensibility. *Journal of the Mechanics and Physics of Solids*. **2003**. Vol.51. P.1127-1146.
[9] M. Zrinyi, H.-G. Kilian, E. Horkay. On the decisive role of finite chain extensibility and global interactions in networks. *Coll. Polym. Sci*. **1989**. Vol.267. P.311-322.
[10] G.M. Bartenev, N.M. Lyalina. Determination of polymers relaxation parameters by the calculation-graphical method. *Vysokomolekulyarnye Soedineniya Seriya A*. **1970**. Vol.12. No.2. P.368-384. (russian)