

The influence of functional ingredients on the physico-mechanical and operational properties of rubbers for the oil swelling sealing elements

© Evgeny N. Egorov, Egor G. Efimovsky, Nikolay F. Ushmarin, Sergey I. Sandalov, Ivan S. Spiridonov and Nikolay I. Kol'tsov*⁺

Department of Physical Chemistry and Macromolecular Compounds. Chuvash State University of I.N. Ulyanov. Moskovsky Ave., 15. Cheboksary, 428015. Chuvash Republic. Russia.

Phone: +7 (8352) 45-24-68. E-mail: koltsovni@mail.ru

*Supervising author; ⁺Corresponding author

Keywords: rubbers, functional ingredients, physico-mechanical and operational properties, oil-swelling sealing elements.

Abstract

In the article was studied the influence of caoutchoucs, sevilene 11808-340, vulcanizing groups, fillers, plasticizers, vermiculite, trans-polynorbornene and needle-punched fabric on the physico-mechanical (tensile strength, elongation at break, hardness, elasticity on rebound, tear resistance) and operational properties (changes in the conditional tensile strength, the volume after exposure to oil, the mass after aging of the rubbers in a solution of citric and hydrochloric acids) of two rubbers. These rubbers are developed for the manufacture of the outer and inner layers of oil-swelling sealing elements (SOE) for the oil and gas extraction industry. It has been established that rubber for the outer layer of SOE based on butadiene-nitrile BNS-18AMN and isoprene SKI-3 caoutchoucs, as well as rubber for the inner layer of SOE based on butadiene-nitrile BNKS-18AMN and butadiene-methylstyrene SKMS-30ARK caoutchoucs at a mass ratio of rubbers 30:70 have the required physical-mechanical and operational properties. It is shown that these rubbers containing a curing group of sulfur + thiazole 2 MBS, sevylyene 11808-340, a combination of technical carbon T 900 with dross 175, talc and chalk, oil-polymer resin "Sibplast", vermiculite and needle-punched fabric, are characterized by improved physical-mechanical and performance properties. These rubbers can be recommended as a basis for the manufacture of the outer and inner layers of oil-swelling sealing elements.

References

- [1] N.I. Koltsov, N.F. Ushmarin, A.E. Petrov, N.P. Petrov, N.N. Petrov, and S.M. Verhunov. Research of influence of technological additives on properties of rubbers on the basis of BNR new generation. Part 1. Vuhtazine RV/g-s. *Butlerov Communications*. **2010**. Vol.19. No.2. P.79-86. ROI: jbc-02/10-19-2-79
- [2] N.I. Koltsov, N.F. Ushmarin, L.G. Rogozhina, S.A. Issakova, A.V. Jarutkina, A.Y. Plehanova, and M.V. Kuzmin. Research of influence of technological additives on properties of rubbers on the basis of BNR new generation. Part 2. Elastid, oxsanoles and factice *Butlerov Communications*. **2010**. Vol.19. No.3. P.75-82. ROI: jbc-02/10-19-3-75
- [3] N.I. Koltsov, N.F. Ushmarin, A.E. Petrov, N.P. Petrov, N.N. Petrov, and S.M. Verhunov. Research of influence of technological additives on properties of rubbers on the basis of BNR new generation. Part 3. Novantox 8 PFDA. *Butlerov Communications*. **2010**. Vol.21. No.9. P.22-28. ROI: jbc-02/10-21-9-22
- [4] N.I. Koltsov, N.F. Ushmarin, L.G. Rogozhina, S.A. Issakova, A.V. Jarutkina, A.Y. Plehanova, and M.V. Kuzmin. Research of influence of technological additives on properties of rubbers on the basis of BNR new generation. Part 4. Powder stabilizers on a basis novantox 8 PFDA. *Butlerov Communications*. **2010**. Vol.22. No.10. P.42-50. ROI: jbc-02/10-22-10-42
- [5] N.I. Koltsov, N.F. Ushmarin, N.P. Petrova, Yu.V. Vasileva, A.V. Yarutkina, N.N. Petrova, A.Y. Plekhanova, and M.V. Kuzmin. Research of influence of technological additives on properties of rubbers on the basis of BNR new generation. Part 5. Fire retardants on the basis of trichloroethylphosphate combinations. *Butlerov Communications*. **2012**. Vol.29. No.2. P.62-68. ROI: jbc-02/12-29-2-62
- [6] S.I. Sandalov, M.S. Reznikov, N.F. Ushmarin, N.I. Kol'tsov. Development of thermo-aggressive rubber for packer elements. *Bulletin of the Kazan Technol. University*. **2014**. Vol.17. No.9. P.129-132. (russian)

- [7] I.S. Spiridonov, N.F. Ushmarin, S.I. Sandalov, and N.I. Koltsov. The effect of hydrogenated butadiene-nitrile caoutchoucs on the properties of rubber for sealing elements. *Butlerov Communications*. **2017**. Vol.50. No.4. P.45-49. ROI: jbc-02/17-50-4-45
- [8] I.S. Spiridonov, N. F. Ushmarin, S.I. Sandalov, E.N. Egorov, and N.I. Koltsov. Influence of functional ingredients on the technological properties of rubber mixtures for sealing elements. *Butlerov Communications*. **2017**. Vol.51. No.7. P.132-136. ROI: jbc-02/17-51-7-132
- [9] I.S. Spiridonov, N.F. Ushmarin, S.I. Sandalov, E.N. Egorov, and N.I. Koltsov. Effect of functional ingredients on the physico-mechanical and operational properties of rubber mixtures for sealing elements. *Butlerov Communications*. **2018**. Vol.53. No.1. P.153-157. ROI: jbc-02/18-53-1-153
- [10] Sh.P. Kazimov, E.S. Abdullaeva, N.M. Radzhabov. A review of the designs of swellable packers and the possibility of their application in Azerbaijani deposits. *Scientific works of NIPi NEFTEGAZ GOSOKAP*. **2015**. No.3. P.43-51. (russian)
- [11] A.B. Livshits, A.Sh. Mingazov, N.F. Ushmarin, S.I. Sandalov, E.N. Egorov, L.P. Starukhin. Composite oil-bearing material. *Patent 2625108, publ. 11.07.2017, the bulletin of inventions No.20*. (russian)
- [12] E.N. Egorov, N.F. Ushmarin, S.I. Sandalov, I.S. Spiridonov, and N.I. Koltsov. The influence of functional ingredients on the technological properties of oil swelling rubber sealing elements. *Butlerov Communications*. **2018**. Vol.54. No.5. P.159-164. ROI: jbc-02/18-54-5-159