

Effect of hydrosorption polymers on the properties of water-swellaable rubber

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Abstract

Currently, in the oil and gas industry there is a growing demand for sealing elements capable of limited swelling upon contact with water and sealing the annular space of certain sections of the well. The swelling capacity of the sealing elements is predetermined by a well-chosen combination of polymer base and targeted functional ingredients. At the moment, a big drawback of water-swellaable sealing elements is the loss of their sealing ability due to the washing out of hydrosorption additives from the sealing element. In this regard, in this work, the effect of hydrosorption polymers (polyacrylamide, sodium carboxymethylcellulose, polyvinyl alcohol and guar gum) on the properties of water-swellaable rubber based on a combination of nitrile-butadiene SKN 1855, acrylate nipol AR22 and chloroprene CR 232 rubbers and epoxy 20 with sulfur curing system. The rubber mixture was prepared by mixing rubbers with ingredients on a laboratory roll LB 320 160/160. The rheological characteristics of the rubber compound were studied on an MDR 3000 Basic rheometer at 150 °C. Standard rubber samples were vulcanized at 150 °C for 30 min in a P-V-100-3RT-2-PCD vulcanization press. The main properties of vulcanizates were determined according to the standards in force in the rubber industry. It is shown that the introduction of polyacrylamide together with sodium carboxymethyl cellulose, polyvinyl alcohol and guar gum into a rubber compound leads to a change in its rheological parameters. Vulcanizates containing a combination of polymers are characterized by lower values of the conventional tensile strength and rebound elasticity, but higher elongation at break and the degree of swelling in distilled and formation water as compared to the vulcanizate of the base version of the rubber mixture.

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