NOVATEUR PUBLICATIONS
JournalNX- A Multidisciplinary Peer Reviewed Journal
ISSN No: 2581 - 4230
VOLUME 6, ISSUE 5, May -2020

RESEARCH OF PROPERTIES OF RUBBER PRODUCTS DEPENDING ON TEMPERATURE

D.U. URINOV,
Assistant of "Ground-based transport systems and their operation" department, Andijan machine-building institute. E-mail: Orinov.d12345@gmail.com

J.M. MAMAJONOV,
Student of "Ground-based transport systems and their operation" department, Andijan machine-building institute.

A.R. MELIKUZIYEV,
Student of "Ground-based transport systems and their operation" department, Andijan machine-building institute.

M.U. OLIMOV
Student of "Ground-based transport systems and their operation" department, Andijan machine-building institute.

ABSTRACT:

It was found that the deterioration of the properties of rubbers occurs after 5-10 minutes of excessive heating or cooling, which leads to an increase in their aging. To slow down aging in the production of rubber materials, antioxidants and antiagers are introduced into their composition, which break off the oxidation chain reactions or prevent oxygen diffusion into rubber and rubber.

KEY WORDS: rubber, rubber, heating, cooling, aging, rubber material, antioxidant, antiager, oxidation, diffusion, oxygen, storage, operation, destruction.

INTRODUCTION

Rubber is irreplaceable structural material belongs to the materials which are extremely widely applied in engineering. Nowadays, more than 40000 names of the most various products are made from rubber. Thanks to high elasticity, ability to absorb vibrations and shock loads, low heat conductivity, good mechanical durability, high resistance to abrasion, distensibility, water tightness, resistance to action of many aggressive environments, ease, low cost and other properties rubber in some cases is irreplaceable material.

Rubber materials at storage and operation gradually collapse. Externally it is expressed by emergence on a surface of a product of small cracks which then extend and go deep. Gradually rubber hardens and its physico-mechanical properties worsen, the elasticity is completely lost. That kind of changing properties is called rubber aging.

Aging belongs to category of difficult multistage transformations at which certain stages considerably decrease elasticity, wear resistance and somewhat rubber durability. In other words, eventually operability of rubber products and consequently also reliability of work of cars decrease. Irreversible decrease in its elasticity belongs to discharge of the most adverse changes of rubber arising owing to aging. As a result the increased fragility of rubber, first of all its surface layers, causes emergence in deformable details of the cracks which are gradually going deep and eventually leading to destruction of a product.

Effects of aging of rubber are similar to effects from fall of temperature, with only that difference that the last in character are temporary and partially or completely removable by means of heating whereas the first cannot be weakened in any ways and the more so to eliminate.

Fight against aging is conducted by different methods. Additive of protivoistaritel (inhibitors) which 1-2% in relation to the rubber which is contained in rubber slow down process of oxidation in hundreds and thousands of times is very effective.

Oxidation of molecules of rubber and rubber is oxygen a basic reason of aging of rubber. Oxygen joins the double communications which are in a linear chain. It leads to disintegration of molecules of rubber and further to their oxidative polymerization with formation of complex molecular structures. Such oxidation is characteristic of rubbers from natural and synthetic isoprene rubbers at which double communications are bred only in a linear chain of molecules and oxidation proceeds intensively. Oxidation in the place of double communications in side chains happens less intensively and is not followed by destruction of molecules. Therefore aging of rubber from synthetic rubbers, with double communications in side chains of molecules, proceeds much more slowly.

With temperature change properties of rubber very strongly change, and the operability of details from it for various reasons decreases both when heating, and when cooling. As appears from fig. 1, with rubber fall of temperature strength grows, and the elasticity falls and at -80 °C it becomes almost equal to zero. Let's note that the rubber durability increasing with fall of temperature as a first approximation under the linear law (fig. 1) reaches at -80 °C approximately the same value what at the room temperature has absolutely deprived of elasticity - ebonite. Change of properties of rubbers at fall of temperature is connected with deceleration in them relaxation processes. Rubber oxidation more intensively on those sections which test bigger tension.

Thus, reduction of elasticity of rubber which in process of cooling approaches on fragility ebonite is the main adverse consequence of fall of temperature. Already at -4 °C the most widespread sorts of rubber are not capable to be deformed reversibly in necessary limits, and only vulcanizers on the basis of special frost-resistant rubbers save the required elasticity at a temperature of 50 °C and below. What follows from that rubber products in winter time require to themselves close attention and the careful address.

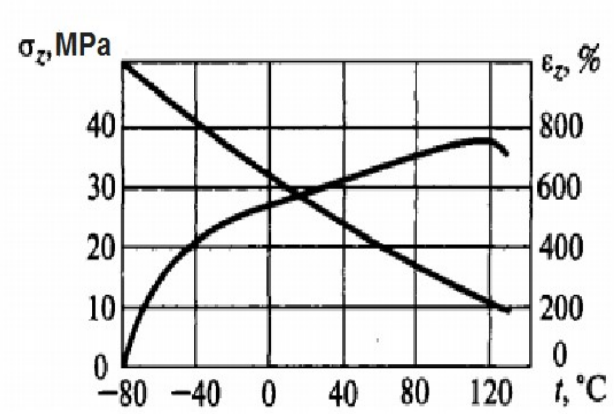

Fig. 1. Dependences of a tensile strength σ_z and relative lengthening ε_z rubbers from natural rubber from temperature

At fall of temperature gradual decrease in highly elasticity properties of rubber products is observed. Depending on properties of rubber and temperature the elasticity is lost partially or completely. Deterioration in elasticity properties of rubber is shown in gradual increase in its hardness and eventually results in fragility. At the same time the rigidity of rubber increases by 10-100 times. With return to normal temperature elasticity properties are recovered. With temperature increase aging amplifies, and from heating the speed of aging increases by each 10 °C twice. Other important

properties of rubber in the operational relation with temperature increase change only for the worse: durability, wear resistance and hardness decrease, and residual lengthening and ability to irreversible deformations increase. So, to heating of rubber from 20 to 100 °C there corresponds twofold and even triple decrease in strength on a gap. Still more the wear resistance and hardness of rubber decrease in this case.

There is also a structuring it to increase in cross communications in rubbers from synthetic rubbers along with rubber destruction, i.e. reduction of length of chains. With temperature increase relative lengthening of rubber increases to 110-120 °C, and at further heating, apparently from fig. 1, begins to decrease. Transition from growth of relative lengthening to its recession is explained by the partial rupture of sulfuric bridges coming at these temperatures between rubber macromolecules which is followed by simultaneous sharp decrease in its elasticity and increase in plasticity.

For deceleration of aging by production of rubber materials enter antioxidants, antiagers which tear off chain reactions of oxidation into crude rubber mix or diffusions of oxygen in rubber and rubber interfere. Eventually antiagers are spent, their concentration in rubber decreases and process of aging begins advance.

It was established that change of properties of rubbers occurs after 5-10 min. heating or cooling. Tension at a gap for all tested materials goes down with increase or fall of temperature.

REFERENCES:

1) Jerichov, V. B. Automotive maintenance materials. Textbook allowance. Part II. Oils and lubricants / SPb. state architect build un-t 2009.- 256 s.
2) Maharramov A.M., Akhmedova R.A., Akhmedova N.F. Petrochemicals and oil refining. Textbook for higher education. Publishing house "Baki Universiteti", 2009, 660 p.
3) Kirichenko NB Automotive Maintenance Materials. - M.: Academy, 2007. -- 208 p.
4) Kuznetsov A.V. Fuel and lubricants. - M.: KolosS, 2007. -- 199 p.
5) Fluids and Lubricants Specifications. Printed in Germany. 2012 Copyright MTU Friedrichshafen GmbH.
6) Under the general editorship of Professor N. Malkin. “Chemists to motorists” - L. Chemistry, 1990.- 482 p.