



Technical Report

Study on evaluation index system of rubber materials for sealing

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ABSTRACT

According to the characteristics of use and evaluation of rubber materials for sealing, the construction flow of evaluation index system was established, and the purposes and contents of evaluation were defined. Based on the principles of scientific, simple and effective, universal, qualitative and quantitative, and continuity, and considering the functions of evaluation, monitoring, guidance, and decision-making, evaluation indicators were selected while applied indicators principles was adopted, and then the evaluation index system was established in view of constitution of rubber materials, basic performance conditions, friction and wear, aging, special performance, and economy. And the combinative evaluation method of quantitative and qualitative was put forward. At last, the evaluation system was applied to evaluation of NBR and nano-Fe₃O₄ MNBR. The results indicated that the evaluation index system can reflect the use connotation of rubber materials for sealing and provide lessons for development and evaluation of other various materials.

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1. Introduction

Rubber industry had a rapid development in the 20th century because of the excellent performance of rubber materials, the lower investment of their production and application, and the obvious economic benefits [1]. Rubber industry is characterized by the elastic body, which has been inimitable in the secondary industry. As a kind of material industry, rubber industry is closely related with polymer industry, and they are “The opposite sex with the family”. Application of natural rubber and starting of rubber industry had made history with the science and industry of polymer materials. Compared with other materials, the unique viscoelasticity and compatibility of rubber is unparalleled, and its value-in-use is increasingly widespread with the development of economy and society. From the early 19th century to now, with the development of industrial economy and advancement of the science and technology, rubber industry has gone through historical periods of formation, development and prosperity, formed independent and complete industrial system, and become an important industry in world economics.

With the development of modern science and technology, sealing technology has attracted more and more attention around the world, and its main contents can be divided into three aspects: sealing materials, sealing structure, and sealing technique. The material is basis, the structure is guide, and the technique is guarantee. For rubber materials, it is one of the very important purposes to be used for sealing.

Basic research is the basis and guide of the development of industrial technology of rubber for sealing. From multi-disciplinary perspective, it studies the structure and performance, the phenomena and behavior, explores new laws, new principles, new methods, and collects basic data, so as to provide new materials and technologies for rubber industry. Evaluation system is the guidelines for reforming rubber industry for sealing [2–7]. It compares and analyses the structure and performance of rubber materials for sealing in various aspects to find the best application architecture and environment for them.

In recent years, scholars conducted many preliminary studies on the evaluation of rubber materials. Sun et al. [8] had determined the basic properties of cold polymerized acrylonitrile–butadiene rubber N41 produced in Lanzhou Petrochemical Corporation and like products, such as RZ, RB, RJ, RN, and the application properties in oil-resistant rubber hose, rubber apron for spinning machines, rubber covered roller and rubber covered roller. The results showed that the basic properties and application properties of N41 were similar to those of foreign products. Gao et al. [9] had tested EPDM, NBR and CR O-rings commonly used in gas insulating switch under the same conditions to evaluate merits and demerits among the three kinds of rubber materials. Analyzing the test results, the comparative orders for mechanical properties, heat-aging or weather-aging resistance, liquid dipping resistance, and low temperature behavior of the three kinds of rubber material were presented, which could be used as a reference for GIS manufacturers to select O-rings. Liu et al. [10] had provided “3G value criterion” to test the tensile properties of rubber bearings in engineering, and performed experimental research with nature rubber bearings and lead plug rubber bearings in order to verify the new model. All test results showed that the computation

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