

4.2.28. DEVICE AND METHOD FOR EVALUATION OF THE RUBBERS PROPERTIES AND DEGRADATION

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At present the estimation of service life and durability of the mechanical rubber goods is extremely important problem in practice. The most sharply this problem is for the articles such as sealants, gaskets, shock absorbers and others, which work in the conditions of aggressive temperature and chemical action. Traditionally for predicting the change of the properties of polymeric materials are used procedures according to ISO 11346:2004, IEC-216 [1, 2]. In accordance with the given normative documents the tests must be carried out on the specially prepared control samples. However, practice shows that the samples and real articles can considerably differ in their properties. In the same time for the consumers of rubbers it is very complicated to prove the fact of the poor quality manufacture of article, for that reason, that the properties should be determined on the samples, which are made separately and they can correspond to all requirements. In this connection for the objective evaluation of the service life of rubber goods it is necessary to perform two basic conditions:

- the method of control should give the possibility of measuring the properties directly of the material of article
- for establishing the periods of the safe operation of the material tested it is necessary to determine the characteristic of material (aging characteristic), which will be sensitive to the change of the sample properties during degradation. In this case the service life will be determined by the limit values of the aging characteristic, established by the practice of the application of the article.

These conditions determined the purpose of this work – to study the possibilities of the indentation methods for evaluating the service life of rubber. As the main method of control the dynamic indentation method was used. This method and device IMPULSE-1R for method application was developed at the Institute of applied physics (Minsk, Belarus).

For the experiments two rubber compounds on the basis of natural rubber with different content of fillers were selected. For the objective evaluation of the possibilities of the indentation method in parallel was produced the comparison of the sensitivity of properties measured by the indentation with characteristics, determined according to ISO and IEC. Experiment showed that the most sensitive during the aging were: dynamic elastic modulus E_d , strength σ_r , elongation at break f_r , modulus at strain of 5 % $E_{5\%}$. As the result were obtained the limit values of E_d , σ_p , f_p , $E_{5\%}$. and the relationship between them for calculating the service life rubbers. The evaluation of the sensitivity of the characteristics, obtained at the static and dynamic indentation to a change in the structure of material was made. The activation energy of the thermal destruction on the basis of data of dynamic indenting was calculated.

References:

1. ISO 11346:2004. Rubber, vulcanized or thermoplastic – Estimation of life-time and maximum temperature of use. – 17 p.
2. IEC 216 Standard, “Guide for the determination of thermal endurance properties of electrical insulating materials”, 4th issue (1990–1994). – 14 p.