Deplasticization influence on the physical properties of PVC-plasticized

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Abstract – The influence of plastic deplasticization on change of its physical properties is investigated. In is established that the removal of the plasticizer is accompanied by reduction of the permittivity, dielectric loss tangent and increasing fragility. Dependence of these characteristics on the limiting mass of plasticizer, removed from the plastic in to mineral oil, of a certain temperature, are described by exponential equations. The parameters of these equations are defined. Keywords – PVC plasticized, plasticizer, limiting mass of plasticizer, mineral oil, fragility, permittivity, dielectric loss tangent.

I. INTRODUCTION

Contacting of the isolation of cables and wires on the basis of PVC plasticized with mineral oil causes it irreversible physical and chemical processes that according to the results of works [1, 2, 3] can be described by a diffusion mechanism for removing plasticizer from plasticized. According to [1, 2, 3], the diffusion deplasticization of plasticized is accompanied by the change in its physical properties. The aim of the work was to study the possibility of nondestructive evaluation of the resource plasticized polymer materials, the failures of which are associated with the removal of the plasticizer and a critical reduction of mechanical strength on the basis of data on changes in electrical properties of the material in the process of deplasticization.

II. MAIN PART

Studies were done on four sets of 100 samples of PVC plasticized. The first set was exposed to the mineral oil temperature of 23 °C, the second – +60 °C, and the third – +77 °C. The critical mass of plasticizer which was diffused out of plastic into mineral oil, of certain temperature was defined as the ratio of the mass of plastic under the steady diffusional equilibrium, that is the mass which is not different more than ± 0.0001 g to its initial mass at two successive weighings. The limiting relative mass of remote plasticizer from plasticized, presented in percentages, for the first set was the average μ₁ = 6.87% for the second – μ₂ = 12.42% and the third – μ₃ = 16.9% [3]. The fourth, the control set, not exposed to mineral oil, was characterized by the limiting mass μ₄ = 0%.

Evaluation of fragility of plasticized was carried out at room temperature by measuring the number of bends ω before infringement of to the integrity of the material. Permittivity εr and loss tangent tgδ of the investigated plasticized were measured with the help of Schering bridge method. Using a computer-software packages STATISTICA 7, corresponding the limiting mass, measurement data were fitted by exponential equations:

\[ ω = 2507316 \times \exp(-0.46 \times \mu_1) \]  
\[ ε_r = 5.7799 \times \exp(-0.0254 \times \mu_1) \]  
\[ tgδ = 0.0589 \times \exp(-0.1306 \times \mu_1) \]

According to the experimental data the interaction of mineral oil and plasticized researched sets leads to the improvement of its dielectric properties and mechanical deterioration. It is because of the deterioration of mechanical characteristics shown by the increasing fragility, plastic compound which is deplasticizing gradually loses its ability to perform the function of the isolating material of electric cables and wires with parameters established by the requirements of technical documentation.

III. CONCLUSION

At a room temperature, the dependence of the fragility, the loss tangent and permittivity of the plasticized on limiting mass of the removed from it plasticizer in mineral oil, described by exponential dependence.

REFERENCES