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A study on the effect of microwave radiation on the operational characteristics of insulating materials based on polyvinyl chloride

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Abstract

In the present paper presents the results of experimental studies of changes in the properties of polyvinyl chloride at relatively low (not leading to a significant temperature increase) doses absorbed energy of ultra high frequency electromagnetic radiation (RF EMR). The relevance of such studies is due on the one hand, extensive use of this polymer in the manufacture of various products, in particular for large-scale production of insulating coatings of pipeline systems and the relatively high (compared with other polymers) the rate of absorption of radiation in the microwave range. From experimental studies it follows that the specific absorbed energy of less than 10 kJ/kg, there was a slight increase in strength properties, and at a dose of more than 30 kJ/kg reduction compared to the unmodified sample. In the energy interval from 15 to 20 kJ/kg the increase, the actual breaking load of more than 1.5 times. In addition, it was found that in the range indicated doses of microwave AMY volumetric electrical resistivity, determined by the presence in the polymer of free carriers and their mobility, takes the maximum value. With the increase of electrical resistivity, the decrease of the free charges, due to the formation of additional bonds and conformational changes of macromolecules, resulting in increased tensile strength. Determined that in the range of radiation doses of 10-20 kJ/kg, a decrease of water absorption in two times. The reduction of moisture absorption can be explained by the increase in the density of a three-dimensional network of macromolecules of the polymer due to the formation of cross-links. The rate of swelling is reduced, indicating the occurrence of a more rigid structure of the modified polymer. Experimentally proved the possibility of using microwave radiation for targeted modification of the structure of the polar polymer that provides an improvement in their physical and mechanical properties. Estimations show that the proposed method improve the performance of less energy intensive and more environmentally friendly compared to traditional way of hardening of PVC products.