

The Effect of Ultraviolet on the Change in the Structural and Mechanical Properties of Polyurethane Foams

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Abstract. The article investigates the influence of ultraviolet (UV) on polyurethane foams' structural and mechanical characteristics. To assess the impact of changes and degradation of foam properties, studies were conducted for two groups of samples: those without exposure to UV and those exposed to natural UV for 3 months. According to the analysis of IR spectra, insignificant chemical changes in the structure of the outer surface of the samples were established as a result of three months of UV influence on the foam. No noticeable chemical changes were found in the inner part of such samples. Compression tests of samples of different groups were carried out under static loading to study the change in mechanical characteristics. Based on experimental tests, changes in the values of mechanical, strength, and deformation characteristics were investigated: Young's modulus, elastic strength, yield strength, and degree of deformation recovery. A conclusion was made about the resistance of polyurethane foam to ultraviolet influence for a period of up to three months.

Introduction

Due to their high thermal insulation characteristics and high degree of adhesion to various materials, polyurethane foams have gained wide use in construction. These materials are obtained from polyol and isocyanate with a blowing agent and other modulating components [1].

The physical and mechanical properties of polyurethane foams can be adjusted by modifying the component composition. Due to this, polyurethane foams are a universal material, as they are in demand and effective in many industries and are used in a wide range of practical solutions [2].

Such materials are widely used in the automotive, furniture, and light industries [3], [4], medicine [5], [6], and the construction industry as insulation [7], for hydro and sound insulation [8], and [9].

However, polyurethane foam products are exposed to external influences during operation, such as mechanical loads, temperature conditions, humidity, and several other factors. Therefore, studies of the influence of operational factors on changes in the operational properties of polyurethane foams allow us to assess the reliability, durability, and cost-effectiveness of technical solutions using this material.

Literature Review

The performance properties of foamed polyurethane products depend on the chemical composition, molecular structure, ratio of main components and content of modifying additives. Thus, polyol produces a soft phase and is responsible for the flexibility and elasticity of the material. In turn, isocyanates form a solid phase of this material, and their amount is a key factor affecting the mechanical characteristics and thermal stability of polyurethane foam [10].

By modifying the composition and technological modes, a wide range of polyurethane foams can be obtained, from soft elastic materials to hard and solid materials, with different densities, porosities, and physical and mechanical parameters [11].