

The Temperature Degradation Process of Siloxane Polymeric Coatings

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Abstract : Study of the effect of high temperatures on polymer coatings represents an important field of research of their properties. Polymers, as materials with numerous features (chemical resistance, ease of processing and recycling, corrosion resistance, low density and weight) are currently the most widely used modern building materials, among others in the resin concrete, plastic parts, and hydrophobic coatings. Unfortunately, the polymers have also disadvantages, one of which decides about their usage - low resistance to high temperatures and brittleness. This applies in particular thin and flexible polymeric coatings applied to other materials, such a steel and concrete, which degrade under varying thermal conditions. Research about improvement of this state includes methods of modification of the polymer composition, structure, conditioning conditions, and the polymerization reaction. At present, ways are sought to reflect the actual environmental conditions, in which the coating will be operating after it has been applied to other material. These studies are difficult because of the need for adopting a proper model of the polymer operation and the determination of phenomena occurring at the time of temperature fluctuations. For this reason, alternative methods are being developed, taking into account the rapid modeling and the simulation of the actual operating conditions of polymeric coating's materials in real conditions. The nature of a duration is typical for the temperature influence in the environment. Studies typically involve the measurement of variation one or more physical and mechanical properties of such coating in time. Based on these results it is possible to determine the effects of temperature loading and develop methods affecting in the improvement of coatings' properties. This paper contains a description of the stability studies of silicone coatings deposited on the surface of a ceramic brick. The brick's surface was hydrophobized by two types of inorganic polymers: nano-polymer preparation based on dialkyl siloxanes (Series 1 - 5) and an aqueous solution of the silicon (series 6 - 10). In order to enhance the stability of the film formed on the brick's surface and immunize it to variable temperature and humidity loading, the nano silica was added to the polymer. The right combination of the polymer liquid phase and the solid phase of nano silica was obtained by disintegration of the mixture by the sonification. The changes of viscosity and surface tension of polymers were defined, which are the basic rheological parameters affecting the state and the durability of the polymer coating. The coatings created on the brick's surfaces were then subjected to a temperature loading of 100° C and moisture by total immersion in water, in order to determine any water absorption changes caused by damages and the degradation of the polymer film. The effect of moisture and temperature was determined by measurement (at specified number of cycles) of changes in the surface hardness (using a Vickers' method) and the absorption of individual samples. As a result, on the basis of the obtained results, the degradation process of polymer coatings related to their durability changes in time was determined.

Keywords : silicones, siloxanes, surface hardness, temperature, water absorption

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