

## **NONISOCYANATE POLYURETHANES AND PROSPECTS OF THEIR IMPLEMENTATION IN INDUSTRIAL PRODUCTION**

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### **ABSTRACT**

The article is devoted to an actual problem of reducing of toxicity of polyurethanes and the prospects for their replacement by nonisocyanate polyurethanes. The main objective of studies in Polymate Ltd. - International Nanotechnology Research Centre - synthesis of nonisocyanate polyurethanes (NIPU), revealing their application properties and the development of recommendations for the development of their industrial production. The article summarizes the results of the synthesis and complex research of properties of nonisocyanate polyurethanes and hybrid compositions. It describes the characteristics of dependence of the properties of nonisocyanate polyurethanes (NIPU) and urethane-containing epoxy polymers (HNIPU) from the component composition and the presence of urethane-containing modifiers. Based on these studies, presented here examples of possible industrial production NIPU, their characteristics of mechanical and chemical resistance, and other important parameters. The article sums up the research on the issue of replacement of existing isocyanate polyurethanes by nonisocyanate polyurethanes, and identifies promising areas of application of research results in industry.

## **THERMORESPONSIVE ISOCYANATE-FREE POLYURETHANES SYNTHESIZED BY DIELS-ALDER POLYADDITION**

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### **ABSTRACT**

This new study is a continuation of our previous work on thermocleavable non-isocyanate polyurethanes (NIPUs), but with a reverse synthesis in order to optimize NIPUs conversion. A bis-furanic hydroxyurethane monomer was synthesized and polymerized with a PPO-bismaleimide in order to yield a thermoresponsive non isocyanate polyurethane (NIPU). Firstly, the reactivity of furfuryl cyclocarbonate ether (FCE) toward primary amine was investigated, and the reaction product was characterized by <sup>1</sup>H-NMR. Then, a bisfuranic hydroxyurethane monomer was synthesized by reaction between FCE and ethylenedioxy(bis(ethylamine)) in bulk, to full conversion. The thermal behavior of this monomer was studied by thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC). The bisfuranic monomer was then polymerized by Diels-Alder (DA) polyaddition with a bismaleimide oligomer. The thermal behavior of synthesized polymer was fully characterized by three complementary analyses. By DSC, retro-Diels-Alder (rDA) temperatures could be measured at 90-130°C. By <sup>1</sup>H-NMR at 100°C, 95% of the adducts are deprotected after 30mn. Finally, by SEC, it was demonstrated that the obtained NIPU polymer chain is sliced up by rDA reaction.

## **EPOXYURETHANE FOAMS**

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### **ABSTRACT**

**It was found that the use of polyaminoalkilphenols allows to produce foamed epoxy materials without of the traditional foaming agents. The reaction between epoxy oligomers and amines is exothermic , for this reason the aminophenol hardener is capable «in situ» polymerization to exude the volatile products, foaming a polymer, in case of the equimolecular ratio of functional groups. The combined use of the epoxy oligomers and cyclocarbonates leads to a more uniform distribution of pores of the foamed polymer and decrease of their size.**