

Can We Meet the New Challenges of NonIsocyanates Polyurethanes (NIPU) towards NIPU Foams?

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Abstract : Generally, linear polyurethanes (PUs) are obtained by the reaction between an oligomeric diol, a short diol as chain extender and a diisocyanate. However the use of diisocyanate should be avoided since they are generally very harmful for human health. Therefore the synthesis of NIPUs (non isocyanate PUs) from step growth polymerization of dicyclocarbonates and diamines should be favoured. This method is particularly interesting since no hazardous isocyanates are used. Thus, this reaction, extensively studied by Endo et al. is currently gaining a lot of attention as a substitution route for the synthesis of NIPUs, both from industrial and academic community. However, the reactivity of reaction between amine and cyclic carbonate is a major scientific issue, since cyclic carbonates are poorly reactive. Thus, our team developed several synthetic ways for the synthesis of various di-cyclic carbonates based on C5-, C6- and dithio- cyclic carbonates, from different biobased raw materials (glycerin isosorbide, vegetable oils...). These monomers were used to synthesize NIPUs with various mechanical and thermal properties for various applications. We studied the reactivity of reaction with various catalysts and find optimized conditions for room temperature reaction. We also studied the radical copolymerization of cyclic carbonate monomers in styrene-acrylate copolymers for coating applications. We also succeeded in the elaboration of biobased NIPU flexible foams. To the best of our knowledge, there is no report in literature on the preparation of non-isocyanate polyurethane foams.

Keywords : foam, nonisocyanate polyurethane, cyclic carbonate, blowing agent, scanning electron microscopy

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