Short Communication

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Mass Spectrometry Congress 2019: Synthesis of rigid polyurethane and effect of silicon surfactant on its properties - M Shafiq Randhawa - University of the Punjab, Pakistan

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Rigid polyurethane foam has been synthesized from high functional crude MDI and blending poly-l for a wide range of surfactant concentration with R141b blowing agent. Cream time, gel time and take free time increase as the concentration of surfactant is increases. The foam density decrease as the concentration of surfactant is increases the decrease in density due to the increase blowing efficiency with surfactant. Surface tension also rapidly decreases in accordance with cell size decrease and close cell content rapidly increase at low surfactant concentration. The decrease of cell size was accompanied by the decrease of thermal conductivity. Today, numerous building blocks and polymer structures are available to chemists and engineers for the synthesis of polyurethanes by the poly-addition principle. Because the manufacturer of polyurethane articles converts low-molecular weight raw materials into finished polymers at the production site, author have place special emphasis on the brief history and some basic concepts about the raw materials and chemistry of polyurethane. He also covers the manufacturing techniques and processing equipment’s in this research article, reviews physical, chemical, mechanical and electrical properties and also cover the applications of all types of polyurethanes for a wide range of industries.

From crude 4,4'-di-phenylmethane diisocyanate (CMDI) and polypropylene glycols (PPG), Rigid Polyurethane Foams (RPUF) have been made. Cream time, gel time and tack free time increased with the addition of surfactant. The density of the foam rapidly decreased to a minimum of 0.5 pphp (part percent polyol) of surfactant due to the increased blowing efficiency with the surfactant. The surface tension rapidly decreased to an asymptotic value at 2 pphp of surfactant. Consistent with this, cell size decreased and the content of closed cells increased rapidly to constant values at low concentrations of surfactant (<1 pphp). The decrease in cell size was accompanied by the decrease in thermal conductivity to give a linear relationship between the two implying that the serial model of heat transfer is applicable.

Polyurethanes (PU) are used as coatings, adhesives, sealants, elastomers (CASE) and fibers as well as flexible, semi-rigid and rigid foams. Therefore, RPUFs find applications such as insulation of refrigerators, freezers, piping, tanks, shipbuilding and LNG cargoes. Foaming can be done by one or two shooting methods. In the one-shot method, all of the materials are placed in a mixing cup and mixed evenly before being poured into a mold. In the two-dose method, isocyanate is added to the mixture in the second step. Foaming can be accomplished with a physical blowing agent, a chemical blowing agent, or a mixture of both. In physical blowing, the reactions between the

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isocyanate and the polyol produce polyurethane bonds with the emission of heat of reaction. As a rule, the thermal conductivity of the blown gas is very low. This, along with a small closed cell structure, results in extremely low thermal conductivity of RPUFs. In chemical blowing, water (the most widely used blowing agent) reacts with isocyanate to form unstable carbamic acid which immediately decomposes into an amine and carbon dioxide. Therefore, the use of environmentally friendly blowing agents has become an important and urgent problem in the synthesis of polyurethane foam. Flexible polyurethane foam is used as a padding for a variety of consumer and commercial products, including bedding, furniture, automotive interiors, carpet padding, and wrapping.

The density of the foam was measured according to ASTM D 1622 with a sample size of 30 x 30 x 30 mm (width x length x thickness), and an average of at least five measurements were taken to report. The density distribution was calculated based on 100 × (maximum density-minimum density) / average density. The closed cell content was determined by an air pycnometer according to ASTM D 2850 with sample dimensions of 50 x 50 x 25 mm. Cell morphology was observed with a scanning electron microscope (SEM, HITACHI S3500N). The samples were cryogenically fractured in liquid nitrogen and powdered gold before being scanned in the upward free direction. Mechanical properties at room temperature were measured using a universal testing machine (Ametek, Lloyd). The compressive strength was determined by ASTM D 1621 at a crosshead speed of 3.0 mm / min with a sample size of 30 x 30 x 30 mm. The force required for 10% deformation based on the original thickness was taken to be the compressive strength of the foam. Surface tension was measured using the K 100 tensiometer (Kruss) according to ASTM D 1331 based on bubble pressure.

RPUFs were made from CMDI and PPG depending on the concentration of surfactant with an environmentally friendly blowing agent (HFC 365mfc). Cream time, gel time and tack free time increased with the addition of surfactant due to the increased stability of the reaction mixture and the rise of bubbles. The foam density and density distribution decreased rapidly to a minimum at 0.5 pphp of surfactant due to the increased blowing efficiency in the presence of surfactant. The surface tension of the foam rapidly decreased to an asymptotic value at 2 pphp of surfactant, implying that the reaction mixture was saturated at this concentration. Consistent with the decrease in surface tension, cell size decreased and the content of closed cells increased rapidly to constant values at low surfactant concentrations (<1 pphp). The decrease in cell size was accompanied by the decrease in thermal conductivity, and a linear relationship between the two was maintained for a wide range of cell sizes. Simple analysis based on a serial model also gave the same result assuming that cell wall resistance is negligible except for small cells. Where there is high surface activity, silicone surfactants are useful for applications. They have recently been shown to improve the effectiveness of microemulsions. Systematic studies of their phase behavior continue to expand our knowledge of the self-assembly

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of large molecules. They are starting to be used to prepare nanostructured materials. The unusual wetting properties of trisiloxane surfactants have been much discussed, leading to a better understanding of the roles of diffusion, surfactant aggregation, and Marangoni effects in improved surfactant spreading.

Biography:

M Shafiq Randhawa has completed his PhD course work from University of the Punjab, Pakistan in Polymer Technology and Engineering. He is the General Manger of Relaxo Pvt. Limited (Chawla group of Industries).