

## **THE DISCOVERY OF SILICONE SURFACTANTS FOR POLYURETHANE FOAM**

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In 1953 Don Bailey initiated a project involving the synthesis of silicone-organic block copolymers. An initial objective was the introduction of chain-stiffening blocks in an effort to prepare copolymers suitable for fibers. This subsequently led to the synthesis of several families of linear and branched Polydimethylsiloxane~polyoxyalkylene block copolymers in which the polyoxyalkylene blocks contained oxyethylene, oxypropylene or mixtures of these two units. A variety of potential end uses were envisioned including release agents, hydraulic fluids, metal and textile lubricants and antifoams. However, an intense period of more than two years of examining the potential utility of these copolymers in a variety of applications did not result in the successful marketing of any new products.

At about this same time, the commercial exploitation of polyurethanes, which had been discovered in Germany during World War II, was being rapidly developed. Foamed polyurethane elastomers had been prepared via a two-step, so-called, prepolymer process. Efforts to improve the overall process and economics were underway in a number of laboratories including DuPont, Mobay and UCC Chemicals. At UCC Chemicals, this effort was led by Fritz Hostettler and Gene Cox. They had found that a combination of certain tin compounds and tertiary amines were highly effective in catalyzing the combined reactions of diisocyanates, polyols and water which was an essential feature of the "one-shot" process. The remaining problem, stabilization of the foaming reaction mass was to prove far more difficult. Hostettler and Cox had tried more than 100 surfactant candidates, including many polydimethylsilicones and a wide range of organics without success. At this point fortune intervened in an unexpected fashion.

Tony Pater was one of several investigators in UCC Silicones who were trying to develop commercial applications for the copolymers prepared by Bailey and O'Connor, but without success. In a final effort to interest other UCC R&D groups in evaluating these new compositions, Tony visited the UCC Chemical lab where he reviewed the extensive efforts by Linde in the preparation and properties of these compounds. Hostettler happened to be at this review and requested samples. Upon their arrival in the early part of 1956, they were quickly evaluated in the prototype "one-shot" system. Within the first few experiments, a new industry was established. The experimental product, X-520, proved to be an excellent stabilizer for the "one-shot" polyurethane foam system and remains an important product for this industry to this very day.