

POLYURETHANE FOAMS MADE FROM BIO-BASED POLYOLS

Hongyu Fan

Dr. Fu-Hung Hsieh, dissertation supervisor

ABSTRACT

Polyurethane (PU) foams have great applications in industry. The raw materials of PU, polyol and isocyanate, are conventionally derived from petroleum. Bio-based polyols are promising substitutes for petrochemical polyols due to their sustainability. This project studied water-blown polyurethane (PU) foams made from soy-polyols. The flexible bio-based PU foams were successfully produced by mixing petroleum polyol and commercial soy-polyols with different hydroxyl numbers and functionalities. The effect of hydroxyl number and functionality of soy-polyols, and the effect of tin catalyst, cross-linker levels and isocyanate index on foam properties were identified. Water-blown rigid polyurethane (PU) foams were made from 0-50% soy-phosphate polyol (SPP) and 2-4% water as the blowing agent. The effects of water content and isocyanate index on physical properties of SPP PU foams were investigated. Low density soy-polyol based rigid PU foams were modified with different concentrations of glass microspheres and nanoclay. The physical properties, especially the mechanical properties, were studied. The effects of high viscosity soy-polyols (13,000 cP to 31,000 cP) on water-blown rigid polyurethane foams (SBO PU foams) containing 1-50% high viscosity soy-polyols were investigated. With regard to density-compressive strength, foams made from high viscosity (21,000 to 31,000 cP) soy-polyols demonstrated comparable or superior value to the control foam.