WATER BASED POLYURETHANE ADHESIVES FOR FLEXOGRAPHIC PRINTING

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Introduction

Water-based polyurethane adhesives are a promising alternative to solvent-based polyurethane adhesives typically used in different academic and industrial research fields, in particular as waterborne adhesives for metals, e.g. flexographic printing bars. With the aim of developing innovative and eco-friendly water-based adhesives for metal substrates, different aqueous polyurethane formulations were prepared via the "pre-polymer mixing process", characterized by three synthetic steps: I) reaction of isocyanates, aliphatic and aromatic, with polyols having high molecular weights to enhance cold-adhesive properties; II) reaction of polyurethanes with amines in order to improve the macromolecular properties and adhesive stiffness; III) preparation of water-based polyurethane emulsions.

Material and Methods

The polyurethane formulations were prepared by reaction of aliphatic and aromatic isocyanates – hexamethylene diisocyanate, isophorone diisocyanate, toluene diisocyanate and diphenylmethane diisocyanate – with high molecular weight polyols – polyethylene glycols and polypropylene ethers -, short chain amines and a comonomer with an acid group as emulsion promoter. The resulting polyurethanes were analyzed via NMR spectroscopy, Differential Scanning Calorimetry (DSC) and Dynamic Mechanical Thermal Analyses (DMTA).

Results

Different waterborne polyurethane formulations were successfully synthesized via the pre-polymer mixing process; adhesive films were prepared via solvent casting deposition using polyethylene terephthalate films as carrier substrates. Polyurethanes macromolecular structure were determined via ^{1}H NMR spectra and their thermal features were assessed via DSC measurements. DMTA analyses were performed on industrial polyurethane adhesives in order to determine reference adhesion and rheological parameters.

Discussion

A preliminary study on polyurethane water-based adhesive formulations for metal flexographic printing bars was performed. The pre-polymer mixing process allows permits a good control over the soft and hard phases of prepared polyurethane samples, modulating the adhesive and the rheological behavior of the resulting polymer films obtained via solvent casting deposition. The work is continuing with an emphasis placed on the study of adhesive and rheological features, related to the microstructural properties, compared with the ones measured for industrial solvent-based samples. Sticker prototypes based on waterborne polyurethane emulsions will be prepared via Mayer bar deposition technique.

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