519b Photo-Polymerization of Butyl Acrylate Using a Narrow Channel Reactor

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Introduction

The aim of this investigation is to study the kinetics of photopolymerization in a narrow channel reactor. A detailed study on the influence of initiator concentration, flow rate, and light intensity on the conversions and molecular weight distributions will be reported in comparison to static film studies (1). This data is being currently used by the process intensification research group at Clarkson University to develop and evaluate the performance of several intensified reactors for polymerization processes.

Background

Some of the distinct advantages of photopolymerization are: better control of the reaction (initiation can be stopped by blocking the radiation), and high reaction rates can be obtained at room temperature (2). UV-initiated polymerizations carried out in stirred tanks suffer poor penetration depth and broad molecular weight distribution (MWD) due to inefficient mixing. The majority of photopolymerization on thin films have been limited to curing applications where mixing is absent. In a narrow channel reactor, fluid is well mixed by the shear effects (3, 4) which will improve the initiator efficiency. Thus, narrow channel reactors are being investigated for photopolymerizations.

Description

Photopolymerization of n-butyl acrylate (BA) in a narrow channel glass reactor (d_i=1.5mm) has been carried out using UV intensity in the range of 50-150 mW/cm^2. 2,2-dimethoxy-2-phenyl-acetophenone is used as initiator. Gas Chromatography was used to monitor the conversion and gel permeation chromatography for the MWD. Comparisons will be made to thermally initiated polymerizations carried out in micro-reactors in regard to the MWD (3). A brief investigation into the penetration depth of the radiation will also be addressed.

The current study involving homopolymerization of BA will be followed by copolymerization with styrene and vinyl acetate. The findings of this research will aid in the understanding of phoopolymerization kinetics and for exploiting other intensified modules.

References

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