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Abstract
Water-borne polyurethane is an important material that has been widely studied and applied for optical and industrial applications. The investigation of this material coupled with inorganic nano-scale particle is of great importance from both scientific and technological points of view due to their unique properties and promising potential applications in opto-electronic device. Therefore 、a combination of water-borne polyurethane and colloidal silica was tried to perform in this study. Waterborne polyurethane (WPU) was synthesized and followed by adding colloidal silica to prepare WPU-silica hybrids. The silica content in the hybrid thin films was varied from 0 to 50 wt%. The experimental results revealed that the viscosity of these hybrid solutions increased with increasing silica content and resulted in the aggregation of silica particle in the hybrid films. The latter result was evidenced by SEM examination. The effect of interaction between silica particle and urethane polymer chains is more significant with increasing silica content. The prepared hybrid films show much better thermal stability and mechanical properties than pure WPU. The optical transparence did not linearly decrease with increasing the silica fraction in the hybrid thin film. At below 20% silica content、the film transparence decreased with increasing silica content; the converse is true at above 20% silica content. These results showed that the prepared hybrid films demonstrated tunable transparence with the silica fraction in the films.
Water-borne polyurethane -acrylate coupled with colloidal silica was also investigated. Water-borne polyurethane bearing acrylate chain was synthesized and follow by adding 3-(Trimethoxysilyl)propyl methacrylate (MSMA)-modified colloidal silica to prepare WPU-Acrylate-MSMA-Silica (WPU-AC-MSMA-SiO2) hybrids. The silica content in the hybrid thin films was varied from 0 to 30 wt %. After UV-radiation、the cross-linked WPU-AC-MSMA-SiO2 films can be obtained. The UV-cured hybrid film show much better thermal stability and mechanical properties are compared pure WPU-AC film. The optical transparence decreases with increase the MSMA-SiO2 fraction in the hybrid film.
Soft propylene glycol-based WPU coupled with colloidal silica was employed to use as a polyelectrolyte in an electrochromic device. After the stability testing of optical contrast、this WPU-silica hybrid exhibits good thermal stability and mechanic characteristics. Optical contrast in the electrochromic device can be readily adjusted through the tuning of silica content in the WPU matrix.
Advisory Committee Chien-Hsin Yang - advisor

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