

Rhodamine B as an Optical Molecular Moisture Probe in a Polymer Matrix

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The absorption spectrum of rhodamine B (RB), a laser dye, incorporated in hydroxypropyl cellulose film exhibits a large increase in absorbance in the visible wavelength region with increasing relative humidity. Addition of water to an ethanol-water solution has a similar effect on the absorption spectrum. In contrast, the absorption spectrum of rhodamine 6G, another laser dye, in the film is not influenced by ambient moisture. These spectral results indicate that the lactone-zwitterion equilibrium of RB exists in the hydrophilic polymer and is strongly influenced by water sorption. In addition, the humidity dependence of the absorbance for RB in the film at 550 nm shows a monotonous and easily reversible characteristic over a wide relative humidity range. The amounts of water uptake of the films with and without RB are identical, indicating that RB can be used as a highly sensitive indicator for moisture without interfering with the water sorption properties of the polymer.

1. Introduction

Organic compounds that show an absorption or fluorescence spectrum dependent on the water content in matrices or glass have attracted considerable attention as possible optical molecular probes for moisture. Such molecules could be the basis for the construction of an optical humidity sensor for industrial use and could also be useful for a study of the interaction between water molecules and other chemical species in matrices.