

Abstract

# New Fluorescent Molecular Probes for Monitoring of Very Fast Photopolymerization Processes of Monomers <sup>†</sup>

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Extremely interesting and important applications of luminescent sensors have been found in research testing polymeric materials by fluorescence spectroscopy. This type of research has contributed to the development of Fluorescence Probe Technology (in short: the FPT method), which is used in the development of applications for fluorescence sensors in a range of kinetic studies of photopolymerization processes and polymerization. This is due to the fact that we have observed dynamic growth in new materials cured by photopolymerization, such as new monomers and photoinitiators as well as their new applications. Most recently, the development of new materials has been supplemented with new techniques for monitoring the progress of very quick photopolymerization reactions, because precise control of the photopolymerization processes is ultimately necessary to achieve a high quality final polymeric product. In particular, there are high hopes for the possibility of monitoring the photopolymerization progress on-line by rapid measurements of such process parameters as the degree of cure, because many properties of the final product depend on the polymerization conditions. Moreover, strict control of the quality of raw materials and the final cured products is required for high production standards. Therefore, there is a high demand for a quick and reliable method of polymerization progress monitoring that would be applicable directly in production lines. Fluorescence Probe Technology is the answer to this type of need, because it is based on the use of fluorescent probes as molecular sensors and quanta of light for information transfer between the probe molecules and the monitoring system. The fluorescent probes react to changes occurring in their vicinity within nanoseconds. Hence, the fluorescent sensors meet the requirements of measurement speed.

On the other hand, recent advances in modern electronics and computer techniques have provided means for rapid analysis of fluorescence emitted by the probes, so it has become possible to acquire and analyse even 10 or more fluorescence spectra of a probe per second, which is necessary for monitoring rapid photopolymerization processes. In the FPT method, changes of fluorescence characteristics of appropriate molecular sensors, caused by changes of polarity or microviscosity of the medium in which the probe is dissolved, are monitored in real time.

In this work, we present new fluorescent molecular probes which can be used to follow photopolymerization processes in full conversion range of monomers. The aim of the work is to study the influence of the structure of the probes on their sensing properties. The properties of the new probes have been compared with those of the classical probes.

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