

Photoinitiation of butyl methacrylate polymerization with alkylaminobenzophenones in solutions

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Using dilatometry and pulse photolysis methods, we have investigated the mechanism of photoinitiated butyl methacrylate polymerization with alkylaminobenzophenones. It is shown that polymerization rate increases with the medium polarity in contrast to benzophenone-amine systems. The alkylaminobenzophenones have been assumed to be bifunctional photoinitiators possessing properties of both aromatic ketones and aromatic amines.

С применением дилатометрии и импульсного фотолиза исследован механизм фотоиницированной полимеризации бутилметакрилата с алкиламинобензофенонами. Показано, что скорость полимеризации возрастает с увеличением полярности среды, в отличие от систем бензофенон-амин. Выдвинуто предположение, что алкиламинобензофеноны являются бифункциональными фотоинициаторами, обладающими свойствами как ароматических кетонов, так и ароматических аминов.

The initiation processes of vinyl monomers photopolymerization with benzophenone alkylamino derivatives, including those in air [1], are investigated for a rather long time because the latter compounds are used widely as sensitizers of different photochemical and photophysical processes. In spite of the fact that these processes are no doubt of practical interest, there is essentially no information on the photopolymerization mechanism. Meanwhile, this question is very important, since photochemical reduction of alkylaminobenzophenones differs in principle from the reduction of other aromatic ketone derivatives due to specificity of their structure. In particular, owing to the presence of substitutes in their molecules, alkylaminobenzophenones can be subjected to photochemical reduction in solutions deprived of electronic or hydrogen donor properties. As a result, new intermediates can be formed in this case, their role in the polymerization initiation processes being unknown.

The study objects were as follows: 4,4'-bisdimethylaminobenzophenone (Michler ketone, KM), 4,4'-bis-diethylaminobenzophenone (DEAB), and 4-dimethylaminobenzophenone (DMAB) purified by repeated recrystallization from ethyl alcohol. The method usually employed for methyl methacrylate [2] was used for purifying butyl methacrylate (BMA). The product was stored at -15°C . Benzene, acetone, and acetonitrile purified according to methods [3] described in literature were used as solvents.

The polymerization rate was judged from dilatometric measurements. The irradiation was carried out using a DKCS-1000 lamp at $\lambda = 365$ nm isolated using a combination of UVC-2 and BC-7 light filters. The light flow intensity was varied using calibrated metal gauzes. The non-stationary kinetic studies were carried out using an automated complex consistent with the pulse photolysis setup described in detail in [4].