PHOTO-AND RADIATION-CHEMICAL PROCESSES IN OIL LUMINOPHORES

A.P. MAMEDOV, R.A. JAFAROVA, M.A. NAJAFOVA, CH.K. SALMANOVA, S.F. AHMADBAYOVA
Institute of Petrochemical Processes named after Y.H.Mammadaliyev, Azerbaijan National Academy of Sciences

In recent years oil luminophores (OL) became objects of numerous studies due to possibility of their use in a number of fields of science and technology which are non-traditional for petroleums and petroleum products. Taking into account that OL during exploitation may undegro an action of solar and artificial as well as nuclear irradiation, some problems arise in relation with photo- and radiation-chemical processes occurring in them. A high rate of these complicated parallel and consecutive experimental technique for retardation of the indicated processes and study of their mechanism.

In the present work for these purposes low-temperature (77K) photolysis and radiolysis of OL have been conducted and a whole number of such methods as absorption spectroscopy, luminessence, ESR and chromatography have been applied which allowed to determine their composition and to clarify elementary stages of photo- and radiation-chemical processes. It has been established by absorption spectroscopy and chromatography that OL obtained from heavy petroleum residues (HPR) of cracking and pyrolysis origin consist of naphteno-paraffinic hydrocarbons (NPH, 57% mas.), polycyclic aromatic hydrocarbons (PAH, 40% mas.), olefine hydrocarbons (OH, 3% mas.) or NPH+OH (10% mas.), PAH (90% mas.).

It has been shown by methods of ESR and luminessence that upon UV- and γ-irradiation of OL at 77K electrons (e), hydrogen (H) atoms, alkyl radicals ($R^{\bullet}$) and ion-radicals ($PAH^{+\square}$, $PAH^{-\square}$, $\hat{I}_2^{-\square}$) are generated with various efficiency. After ceasing photoirradiation of OL phosphoressence arises the colour of which coincides with the colour of photoluminessence giving rise to deem the glow of which is caused by the reaction $e+PAH^{+\bullet}\rightarrow PAH^{*}\rightarrow PAH+h\nu$. Linear heating of photoirradiated samples has shown that there arises glow, maxima of which are at 108, 165, 198, 323, 371, 403K. When heating γ-irradiated samples, in addition to these maxima, the glow at -3 and 46°C is observed which corresponds to hardening temperatures of luminophores of cracking and pyrolysis origin. Here, the intensity of the low-temperature maxima turns out to be larger than in the case of the photoirradiated samples. It has been shown by ESR method that at 77K and in the range of the indicated low-temperature maxima of thermoluminessence (TL) annihilation of e, H, $O_2^{-\bullet}$ and $R^{\bullet}$ occurs. Thus, these maxima have a bimolecular recombinational character. High-temperature maxima of TL arising in the field of diamagnetic state of OL have a monomolecular dissociative character and are related to decompositions of alkyl and cyclic peroxides formed upon heating of the irradiated OL. Special experiments have shown that photodecomposition of the molecules of NPH and OH takes place through sensitization as a result of two-photon absorption by NPH. Comparison of the results of studying photo- and radiation-chemical processes has demonstrated that their common features and particularities are chiefly related with different ratio of excited and ionized molecules of OL.