PS

COMPARATIVE ANALYSIS OF THE THERMAL DECOMPOSITION KINETICS OF POLYETHYLENE GLYCOL FUMARATE–ACRYLIC ACID COPOLYMERS

M.Zh.Burkeev, A.Zh.Sarsenbekova, S.Zh.Davrenbekov, A.N.Bolatbay

Buketov Karaganda State University, Karaganda, Kazakhstan
E-mail: chem._akmaral@mail.ru

One of the most important applied issues of chemistry of high-molecular compounds is the creation of heat-resistant polymer and composite materials. Such materials will preserve its properties influenced of high temperatures, aggressive media, moist and other destructive factors. From this viewpoint, methods of dynamic thermogravimetry allow defining the activation energy of thermal destruction, which is used for characterization of mechanisms of thermal destruction and stability of polymers.

Issue on which method will be applied for definition of kinetic parameters of polymer destruction and composite materials seems to be urgent. Earlier the possibility to apply non-isothermal methods of calculation to define the thermodynamic parameters of polymers [1] was shown.

In this work we showed the possibility to apply isothermal models of calculation for defining main kinetic parameters of copolymers decomposition on the base of the polyethylene glycol fumarate with acrylic acid.

Authors have chosen the following models: Friedman [2], Flynn-Wall-Ozawa [3] and NPK [4]. They proved themselves well at processing of data of differential-thermal analysis of nonorganic compounds. NPK is the only method, which allows to estimate the influence of temperature and conversion on reaction rate.

Studies have shown that the simultaneous use of the TG/DTG data for kinetic analysis gave a more complete picture of the thermal destruction of the p-EGF–AA copolymers. This made it possible to evaluate the kinetic parameters using three kinetic methods and to compare the activation energies obtained from the experimental TG and DTG data.

Thus, the Friedman and Flynn–Ozawa–Wall methods give the invariant part of the activation energy, but the kinetic description is too formal. The NPK method offers two main advantages: (a) the possibility of separating two or more steps of the complex decomposition reaction and (b) the possibility of discriminating between the degrees of conversion via the corresponding temperature functions from the rate equation.

References

1. Burkeev M.Zh., Sarsenbekova A.Zh. et al. Thermal Destruction of Copolymers of Polypropylene Glycol Maleate with Acrylic Acid // Russian Journal of Physical Chemistry A. 2015. – Vol. 89. – №12. – P. 37.
2. Friedman H.L. Kinetic of thermal degradation of char-forming plastics from thermogravimetry. Application to a phenolic plastic. // Journal of Polymer Science Polymer Symposium. 1964. – Vol. 6. – P. 183-195.
3. Flynn J.H., Wall L.A. A quick, direct method for the determination of activation energy from thermogravimetric data. // Journal of Polymer Science Part C: Polymer Letters. 1966 – Vol. 5. – № 4. – P. 323-328.
4. Sempere J., Nomen R., Serra R. Progress in Non-parametric Kinetics. // Journal of Thermal Analysis and Calorimetry. 1999 – Vol. 2. – №56. – P. 843.