CONE CALORIMETER TESTS IN THE RESEARCH OF MECHANISM OF POLYMERS BURNING

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Oxygen consumption calorimetry as it is used in a cone calorimeter provides a set of useful data concerning the sample ignition, burning and extinction and the kinetics of the heat release rate, release of smoke, CO and CO_2, mass changes, etc. may well be assessed. Many publications appeared from the first pioneering papers and construction of the first instrument designed by V. Babrauskas. The flammable sample is put at the arm of balance where it is exposed to the cone heater at a certain cone radiancy and ignited by a spark, microburner or self-ignited. The main parameter determined – the heat release rate (HRR) – is measured from the decrease of oxygen concentration in the flow of air (24 l/s approximately) in calorimeter exhaust duct. From 50 thermally thin polymers (up to 2 mm thick) from the ResinKit (Woodstock) HRR for burning of polypropylene filled with different inorganic fillers (calcium carbonate, glass, baryum sulfate) conducted at the heat radiance 35 kW/m^2 are shown in the Fig. 1. The time to ignition, smoke release, the average cone calorimeter combustion heats and the mass loss were compared and discussed from the viewpoint of the polymer degradation route and its composition. Nonisothermal thermogravimetry runs in nitrogen were related to the peak heat release rates in cone calorimeter experiments (Fig. 2) and to the total amount of volatiles being formed during polypropylene degradation. The significance of single parameters determined from cone calorimeter tests such as MARHE (maximum rate of average heat emission) has been outlined.

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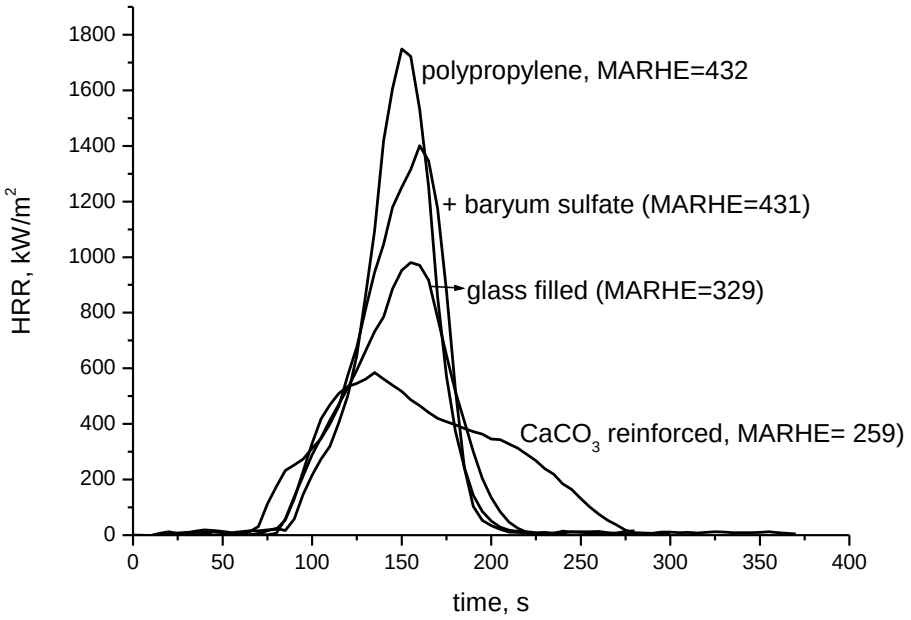

Fig. 1. The heat release rate evolution for the burning of filled polypropylene in a cone calorimeter. Cone radiancy=35 kW/m^2.

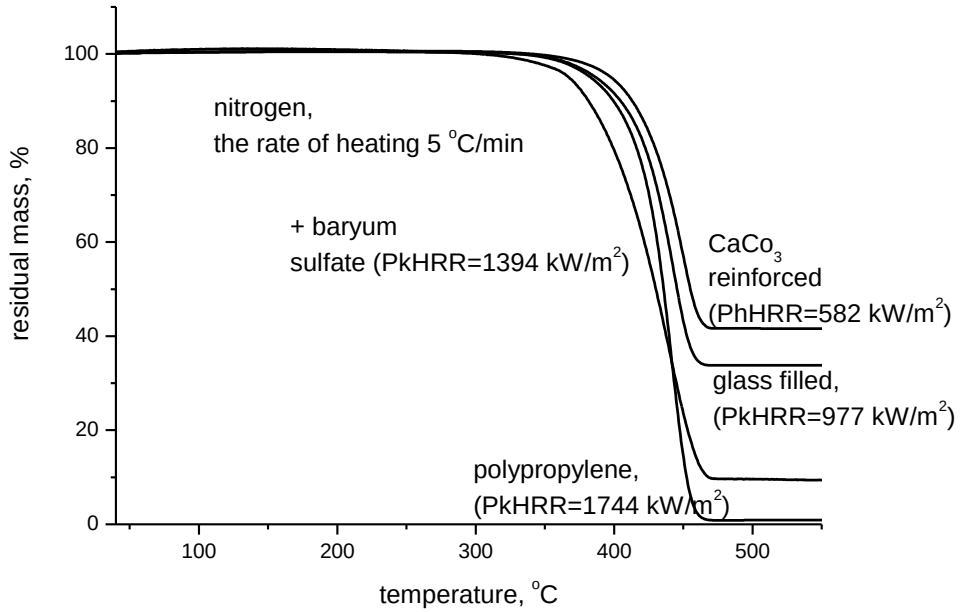

Fig. 2. The mass loss from filled polypropylene in nitrogen, the rate of heating 5^{o}C/min.