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Note

THE OXYLUMINESCENCE OF SELECTED COPOLYMERS

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Oxyluminescence (OL) measurements of polymers are normally carried out in the isothermal mode [1]. At constant temperature, OL curves are useful in determining the concentration of antioxidants in polymers [2] and also in investigating the mechanism and kinetics of the OL process [1]. Wendlandt [3] found that in the non-isothermal mode, OL could be used for the characterization of polymers, after a correction is made for the photomultiplier tube background emission. Polymers studied by this method include selected nylons [3], cellulose derivatives [4], numerous vinyl polymers [5], and others. Each OL curve appears to have a unique temperature distribution for the polymer and, hence, can be used to characterize that substance.

This short investigation continues this technique with the characterization of selected copolymers by OL.

EXPERIMENTAL

The OL apparatus used has been previously described [6]. A furnace heating rate of 12°C min^{-1} was employed on samples whose mass ranged from 10 to 20 mg. All measurements were made using a dynamic O_2 atmosphere with a flow rate of about 40 ml min^{-1}. The voltage outputs from the photometer and a Chromel–Alumel thermocouple (system temperature sensor) were recorded on a Bascom-Turner Model 8110-4 data center recorder [7]. The corrected OL curves were plotted by subtracting out the photomultiplier tube background emission, as previously described [3].

The polymer samples, in powdered form, were obtained from Scientific Polymer Products, Inc., Webster, NY.

The abbreviations used here for the copolymers are as follows: SA = styrene/acryonitrile copolymer; SAL = styrene/allyl alcohol copolymer; SM = styrene/maleic anhydride copolymer (50/50); VV = vinyl alcohol/80% vinyl butyral copolymer; SI = styrene/isopropene copolymer (14% styrene); and SB = styrene/butadiene copolymer (30% styrene).

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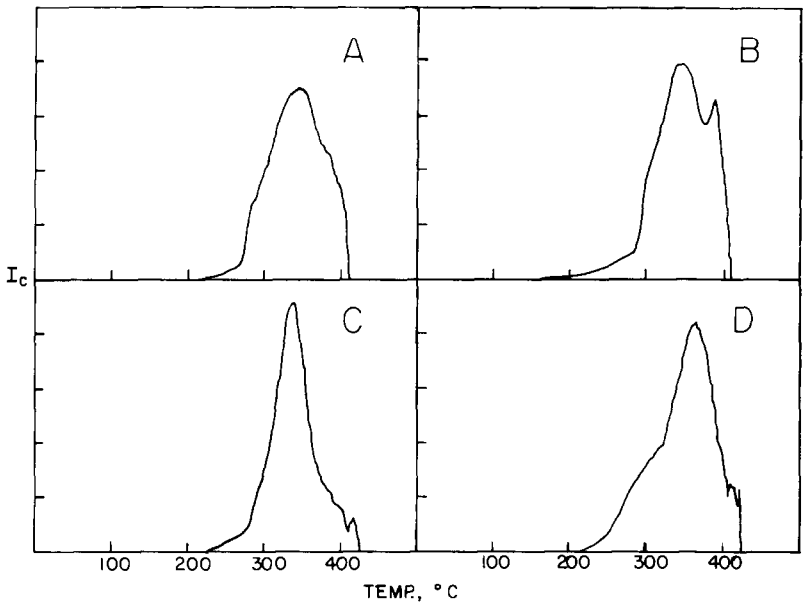

Fig. 1. OL curves of copolymers. (A) SA, 20% acrylonitrile; (B) SA, 30% acrylonitrile; (C) SA, 25% acrylonitrile; and (D) SAL, 5.4–6% hydroxyl.

RESULTS AND DISCUSSION

The corrected OL curves (I_c vs. temperature) are given in Figs. 1 and 2. The OL curves for most of the copolymers studied were in the 200–400°C

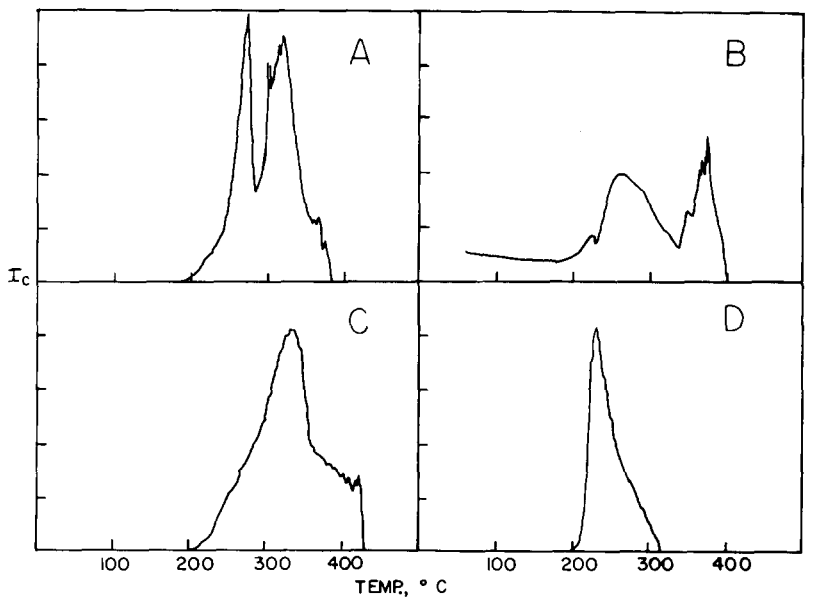

Fig. 2. OL curves of copolymers. (A) SM; (B) VV; (C) SI; and (D) SB.

temperature range while SB had an OL peak in the narrower 200–300°C temperature interval. Most of the curves consisted of a single peak maximum with the exception of the curves for SM and VV (two major peaks).

In comparing SA copolymers with amounts of acrylonitrile varying from 20 to 30%, the OL peak maximum at about 350°C was present in all of them. However, for the copolymer with 30% acrylonitrile, a shoulder peak was also observed with a peak maximum of 390°C.

For SM, the OL curve contained two peak maximas, with peak maxima temperatures of 275 and 325°C, respectively. The latter peak was located at approximately the same temperature as the peak maximum in SI.

As with the previous polymer characterization studies, most of the copolymers exhibited a unique OL curve. Although only one heating rate was employed, perhaps slower heating rates would reveal additional shoulder-peaks or separate curve peaks which could also aid in the characterization process of these copolymers.

ACKNOWLEDGMENT

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