

Relation of phosphorescence spectra with structure transformation in benzophenone

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A new crystal γ modification of benzophenone is first described basing on basis of investigation of phase transitions using differential scanning calorimetry. The relationship between peculiarities of the benzophenone phosphorescence spectra and γ modification presence is discussed.

Впервые сообщается о наблюдении новой γ -модификации бензофенона на основании исследования фазовых превращений методом дифференциальной сканирующей калориметрии. Обсуждается связь особенностей в спектрах фосфоресценции бензофенона с наличием γ -модификации.

Benzophenone is known to exist in two crystal modifications, namely, stable α and unstable β ; besides, benzophenone can take a glass form X . The X modification can be obtained by abrupt cooling of the liquid phase; α and β modifications are formed only from X -modification by heating it up to supercooled liquid benzophenone and further on. Visual observation exhibits the temperature range of about 240 K to 250 K where the growth of β -phase microcrystals is started. The β modification is unstable and transits into α one as temperature increases. At room temperature, only α modification is stable while at 77 K, all ones (α , β and X). For more details, see [1].

The photoluminescence of each benzophenone modification has been studied in [1], and some peculiarities have been observed only in the β modification spectra that can not be explained in the frame of uncombined modifications or mixing of the known ones. The peculiarities manifest themselves as a new band series. In order to understand the nature of those new bands the temperature dependence of their quantum yield have been studied as well as that for β

modification ones. In this paper, we also have used the differential scanning calorimetry (DSC) to obtain detailed information on phase transitions in benzophenone.

The DSC measurements were carried out using Perkin Elmer DSC 7 at the heating/cooling rate 20°C/min. For the first time the full picture concerning all phase transitions occurring in benzophenone in the temperature range from 143 K to 353 K was obtained.

Fig.1, curve 1 shows the DSC under heating for α modification. Only one strong transition at 323.9 K corresponding to melting point of α -benzophenone is observed. Under cooling the molten benzophenone, the DCS curve 2 (Fig.1) is obtained. On this curve, only one low-energy transition at about 211.7 K is seen corresponding to the freezing, that is, the glass phase (X -modification) formation.

Fig.1 (curve 3) shows the second under DSC heating experiment, but in contrast to the curve 1, now for X -benzophenone. In this case, all temperature-inducing structure transformations of X -benzophenone are observable. First, glass benzophenone is transformed to supercooled liquid state at