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THE PHOTOCONDUCTIVITY OF 1,5-DIACETYLANTHRACENE

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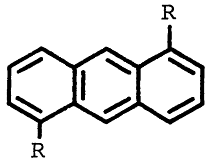
1,5-Diacetylanthracene shows the anomalous photocurrent in the threshold region of the absorption spectrum when the evaporated film of 1,5-diacetylanthracene is irradiated with monochromatic light at various wavelengths under a nitrogen atmosphere.

We now report that 1,5-diacetylanthracene (I) shows the photoconduction spectrum having a large peak in the threshold region of the absorption spectrum, although 1,5-diethylanthracene (II), 1,5-dichloroanthracene (III), 1,5-dimethoxyanthracene (IV) and anthracene (V) do not show such a phenomenon under the similar condition.



I : R = $COCH_3$
II : R = CH_2CH_3
III : R = Cl
IV : R = OCH_3
V : R = H

(I) was synthesized by acetylation of anthracene in the presence of aluminum chloride according to the procedures of Bassilios and his co-workers.$^{1)}$ The other anthracenes (II, III, IV and V) were synthesized by the methods described in the literatures.$^{2)}$ All samples were purified repeatedly by means of chromatography over neutral alumina (eluted with benzene or chloroform), recrystallization (from benzene) and vacuum sublimation until the column chromatogram showed one band.

A "surface-type" cell with the electrodes of the evaporated aluminum was prepared by the vacuum evaporation method.$^{3)}$ The cell was irradiated from the electrode side with the monochromatic light at various wavelengths under a nitrogen atmosphere (Xe arc lamp as the light source). The DC photocurrent at an applied electric field of 1300 V/cm was measured by Ultra-high-megohmmeter (TR-15, Takeda Riken Industry Co., Ltd.). The obtained values (i_p) were corrected for the variation of the light intensity (L), based on $i_p \propto L^{1.0}$.

Fig. 1 shows the corrected DC photocurrent and absorption spectra of the evaporated films of (I) and (III). Although the absorption spectrum of (I) showed no observable peak in the region of 470-480 nm, the peak of DC photocurrent appeared clearly in this region. On the other hand, the DC photocurrent curves of (II), (III), (IV) and (V) corresponded to their light absorption curves. The anomalous photocurrent of (I) increased linearly with the rise of the applied electric field up to 2200 V/cm. Furthermore, it decreased linearly with the decrease of the light intensity at 470 nm by a filter. Thus, the substitution of the acetyl group at 1,5-position of the anthracene ring brought about the appearance of the photocurrent in the threshold region. The similar phenomenon was observed also in the case of 1-acetylanthracene, although the peak was not sharp. This type of the spectral response is known in the photoconduction in p-chloranil^4) and 7,7,8,8-tetracyanoquinodimethane^5) and is explained in terms of impurity photosensitization. In order to investigate the effect of the impurity, we carried out a repeated purification of (I) by means of column chromatography and thin layer chromatography. However, the relative intensity of the photocurrent in the region of 350 - 500 nm did not change. Furthermore, the contamination of 1,5-diacetylanthraquinone in (I) also did not result in the change of the relative intensity. Furthermore, although the photocurrent at 400 nm became larger about 1.5 times in an atmosphere of air, as is found in the case of anthracene,^6) the anomalous photocurrent was insensitive to air. These facts suggest that the appearance of the anomalous peak is not due to the impurity, but is caused by the acetyl group at 1- and/or 5-position. In addition, the anomalous photocurrent was observed in the evaporated film of (III) containing (I) in the (I)/(III) molar ratio of 1/27. This fact also may indicate that the acetyl group brings about the anomalous phenomenon.

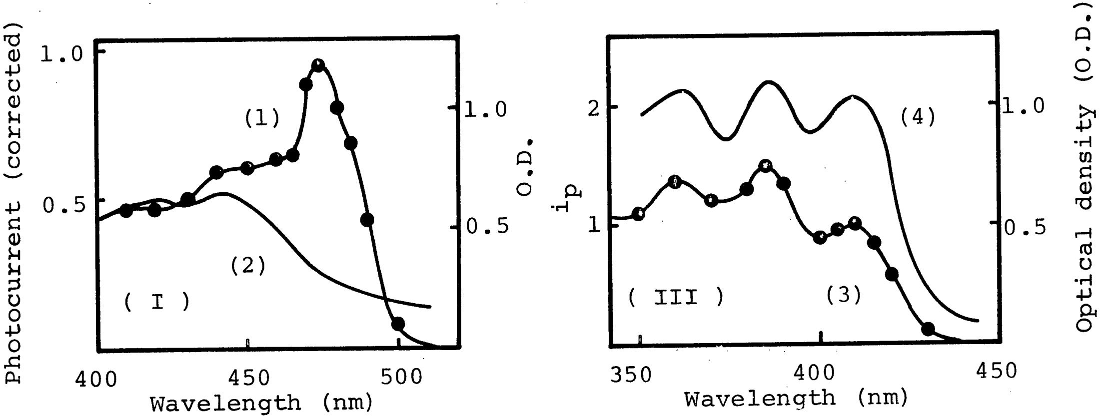


Fig. 1. The photocurrent (1 and 3) and absorption (2 and 4) spectra

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