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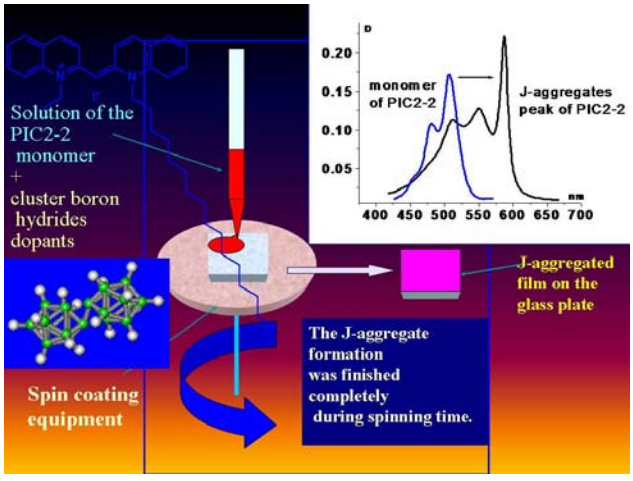
J-AGGREGATED FILMS OF CYANINE DYES

Description

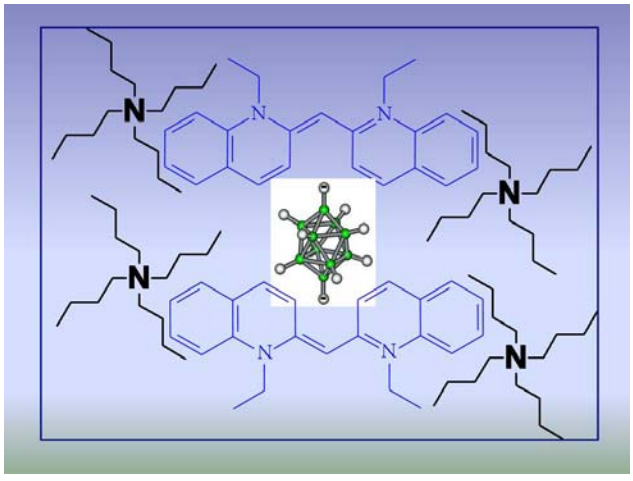
J-aggregates of cyanine dyes attract special attention of the researchers due to their high efficiency in transfer of excitation energy in molecular heterogeneous systems. Formation of a narrow absorption peak – J peak – which is bathochromically shifted relative to the absorption of monomeric form of a dye is the main characteristic of J-aggregation.

The cyanine dye 1,1'-diethyl-2,2'-quinocyanine (pseudoisocyanine - PIC) is known as the dye which form molecular aggregates in aqueous solutions efficiently. PIC J-aggregates can be formed in aqueous solutions and frozen water and ethylene glycol glasses. However, the methods of J-aggregate formation in aqueous solutions or frozen glasses do not give stable reproducible samples, which impede their use as optical or non-linear materials. To study and apply non-linear optical properties of J-aggregates it is necessary to have solid, stable and reproducible samples. Novosibirsk Institute of Organic Chemistry of the Siberian Branch of RAS has developed a new method of producing stable solid nanometer PIC J-aggregate films of high optical quality in both pure form and in polymeric matrixes and studied their optical, thermal and non-linear optical properties.

For the first time there have been obtained the samples of stable nanometer PIC J-aggregate films with controlled width of molecular exciton absorption.



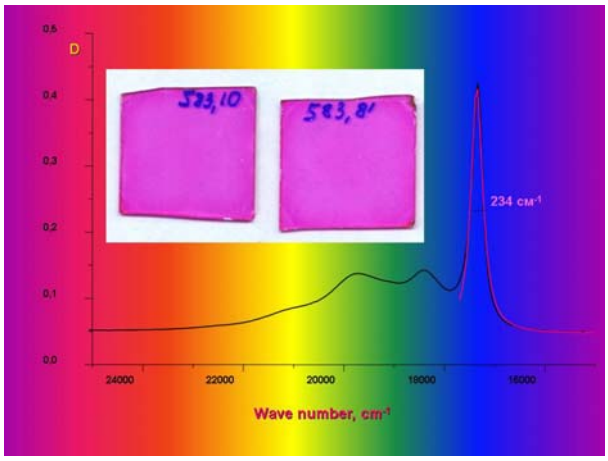
The method of obtaining J-aggregates in thin films



The structure of aggregate with narrow excitonic line

Application

J-aggregates are viewed as effective non-linear optical media. Non-linear materials can be applied in the creation of ultrafast optical switching devices for the next-generation telecommunication systems and the systems of optical coherent signal processing parallel to the time of picosecond or a hundred of femtoseconds.



Films and spectrum of exiton absorption of J-aggregate

Advantages

A unique combination of high nonlinearity value $|\chi(3)|$ ~ 10-5 ESU with ultrafast (~300 fs) relaxation time makes it possible to use nanodimensional J-aggregates of cyanine dyes in photonics.

There are four main advantages of using cyanine dyes J-aggregated films as non-linear optical switches:

- ◊ the use of ultrashort pulses (<1 ps) of light excitation
- ◊ availability of high values of non-linear absorption and refraction in J-aggregates
- ◊ fast relaxation time (<1 ps) of non-linear response of J-aggregates
- ◊ accessibility of obtaining optical films on a large square

Commercial offers:

Aggregated films can be obtained in the quantity from the dozens to the hundreds of 2.5x2.5 sm. pilot samples on glass base. Contracted price per a film sample depends on the type of dyes (from 300 rubles)

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