

# Organic Dyes Containing Fluorene Entity in the Spacer for Solar Cells Application

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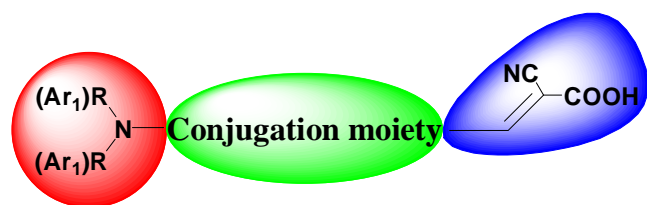
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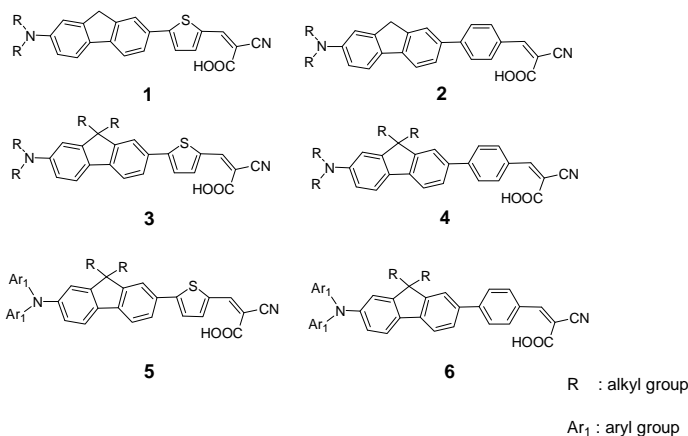
## Abstract

Series of dyes containing a fluorene entity in the spacer have been designed, synthesized, and characterized. These dipolar compounds contain an arylamine or dialkylamine as the electron donor, a 2-acrylic acid as the electron acceptor, and a conjugated spacer between the donor and the acceptor. Typical dye-sensitized solar cells (DSSCs), with an appropriate illumination area, were fabricated with a liquid electrolyte composed of iodide reagent in polar solvent. The device performance data were obtained under AM 1.5 illumination. DSSCs using these materials as the sensitizers exhibited good performance ( $\eta$ ), ranging from 4.58 %-5.82 %, which reached 67 %-85 % with respect to that of the standard cell from N719-based device fabricated under similar condition. Further structural modifications to improve "photon-to-current efficiencies" (IPCE) is in progress. The patent is pending.

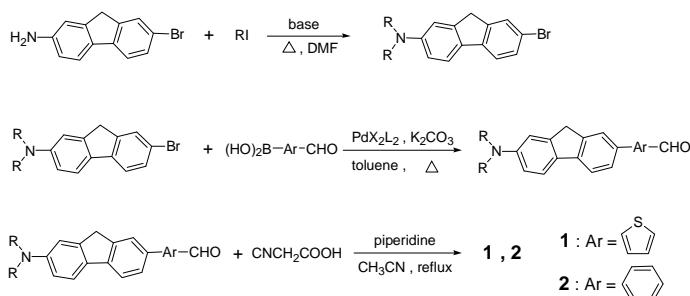
## The general configuration of organic dye



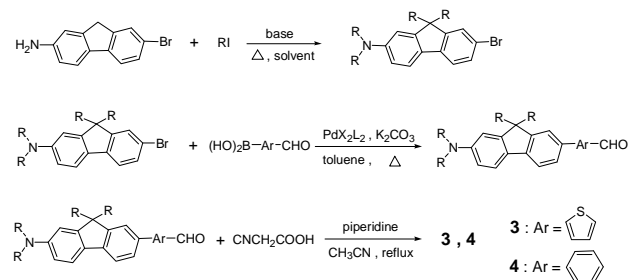
## The structure of six new dyes



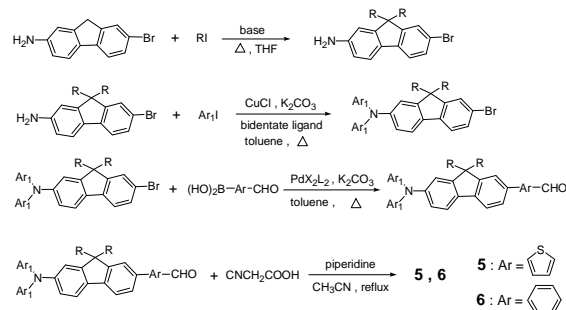
## Synthesis of organic dye 1 and 2



## Synthesis of organic dye 3 and 4



## Synthesis of organic dye 5 and 6

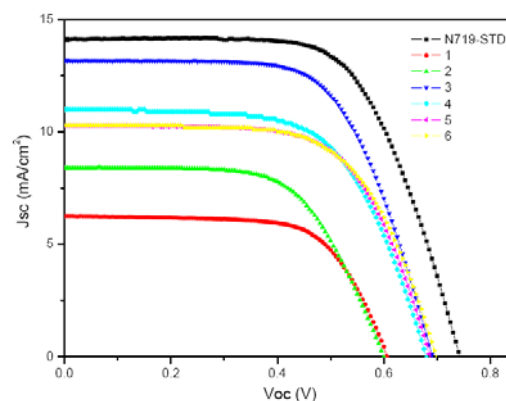


## Performance parameters of DSSCs constructed using the dyes

Dye	J <sub>SC</sub> (mA/cm <sup>2</sup> )	V <sub>OC</sub> (V)	FF	η (%)
1	6.28	0.61	0.66	2.54
2	8.40	0.60	0.63	3.15
3	13.16	0.69	0.64	5.82
4	11.00	0.68	0.58	4.68
5	10.28	0.69	0.65	4.90
6	10.30	0.70	0.63	4.58
N719	14.12	0.74	0.65	6.81

Experiments were conducted using TiO<sub>2</sub> photoelectrodes with approximately 18 μm thickness and 0.25 cm<sup>2</sup> working area on the FTO (15 Ω/sq.) substrates.

## I-V curves of DSSCs based on the dyes



## Conclusion

- We have successfully synthesized dipolar compounds where the electron-donating aryl(alkyl)amine and electron-accepting 2-cyanoacrylic acid were linked by fluorene-containing spacer.
- The best performance of the device reaches ~85 % of N719-based DSSC (6.81 %) fabricated and measured under similar conditions.
- It only takes three synthetic steps to produce the dye 3 which has the best performance of the DSSC.