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Nanostructured Cyclic Indole Derivatives/ Nanocarbon Composites for Supercapacitors and Proton Batteries

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The author's group has newly attempted to form nanostructured cyclic indole trimer (CIT) derivatives/ nanocarbon composites for use in supercapacitors and proton batteries. CIT derivatives such as cyclic indole trimer, cyclic 5-cyanoindole trimer (5-cyanoCIT), and cyclic 5-carboxyindole trimer (5-carboxyCIT) were synthesized and fabricated to form π-stacked structure exhibiting both high capacity (65~92 mAh g^{-1}) and long cycle life characteristics (over 10,000 cycles with little capacity loss of about 5~10% of the initial capacity density) in acidic media[1)] and others.

By hybridizing CIT derivatives with Ketjen Black (KB), the specific capacity increased about 10~20%. Among them, especially 5-carboxyCIT showed 111 mAh g^{-1} per active cathode material, where specific capacity was the highest. This could be attributed to the fact that 5-carboxyCIT have three carboxyl groups in itself, which are redox active. 5-carboxyCITs interact with one another via carboxyl or hydroxyl group by forming hydrogen bond. The 5-carboxyCIT may have an electrocatalytic effect by forming such networked structure on the KB surface.

In this paper, the electrochemistry and electrochemical capacitor behavior of those nanocomposite electrodes will be introduced and discussed.

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Reference

1. K. Naoi *et al*., Abstract of the 201st Meeting of the Electrochemical Society in Philadelphia, PA, USA abstract no.18(2002).

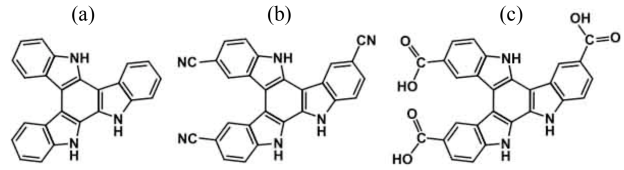

Fig.1 Structures of (a) CIT, (b) 5-cyanoCIT, and (c) 5-carboxyCIT.

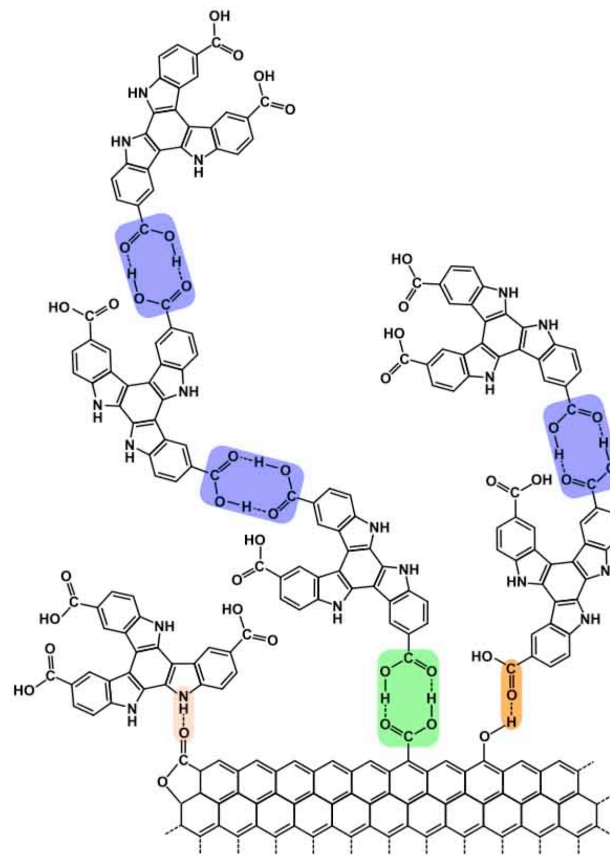

Fig.2 Schematic illustration of the networked structure of 5-carboxyCIT formed on the surface functional group of the KB.