

## Cationic N-doped carbon wrapping CNT to enhance electrical conductivity

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Recently, many studies have examined high-performance carbon materials for application in the next-generation of batteries. Cationic N-doped carbon (CN-C) and Cationic N-doped carbon rapping CNT (CN-C@CNT) were easily synthesized via a new route in solution plasma (SP) at ambient temperature and atmospheric pressure. Our approach provides the following major benefits: fast process, simple device configuration, and one-pot process for the synthesis of CN-C and CNC@CNT simultaneously. Plasma was generated between two nickel electrodes immersed into a suspension of CNT in a mixture of aniline and HCl. This electrode was used for discharging for 15 minutes under the conditions of 0.5 mm distance between electrodes, frequency 35 kHz, pulse width 1.0  $\mu$ s, the CN-C@CNT of hybrid composite was obtained. We have successfully fabricated a very stable hybrid composite structure that wrapping CN-C on CNT for electrocatalytic applications. The morphology of hybrid composite were confirmed by FE-SEM and TEM. This electron microscope images clearly shows that each CNT is uniformly coated with CN-C. The nitrogen content was confirmed to be 7.8% by XPS and the cation nitrogen amount increases 1.6 times in CN-C@SWCNT compared to CN-C. The electrical properties were evaluated by 4 probe method. By using SP-synthesized the CN-C@CNT presented an electrical conductivity of 120 S/cm, which is comparable with that of SP-synthesized CN-C (4 S/cm), N-doped carbon nanofibers (15 S/cm, Ismagilov et al., Carbon, 2009) and N-doped carbon nanotubes (25 S/cm, Fujisawa et al., Nanoscale, 2011).

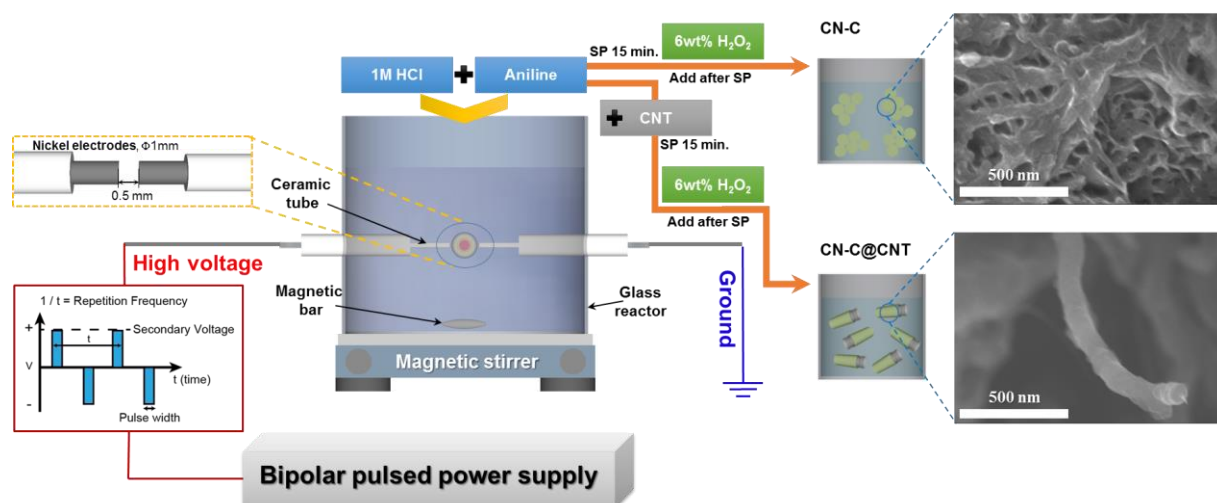


Fig. 1. Methods for synthesis of N-doped carbon and N-doped carbon Wrapping CNT

**Keywords:** Cationic N-doped carbon wrapping CNT, solution plasma, electrical conductivity.