Advanced Erbium-Polyaniline Quantum Dots Composites for Next-Generation Energy Storage

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Simultaneous harvesting of sunlight and storing its energy in optoelectronic devices is a scientific challenge. The current work pursues two main goals: 1) to understand the interaction of erbium ions with stable PANI quantum dots (8 nm), obtained by acid-assisted polymerization method, and 2) to investigate the potential application of Er-PANI:PSS composite as a next-generation energy storage system. Stable PANI quantum dots of 8 nm size are obtained by the acid-assisted polymerization method for the first time. These nanoparticles were further stabilized by PSS and decorated with erbium ions. FTIR and XPS analyses confirm that no direct erbium-PANI coordination is observed; nevertheless, PANI is likely present in the second coordination sphere of the erbium complex, potentially enabling energy transfer between the PANI π-system and Er3+ ions. CV and LSV measurements show that the incorporation of Er^{3+} ions into the composite leads to a marked improvement in electrochemical performance. A further enhancement in areal current was achieved under light irradiation, particularly when using a 655 nm LED, which corresponds to one of the most intense regions of the solar spectrum. This enhancement in electrochemical performance directly translates to a significant increase in specific capacitance; the pristine PANI:PSS suspension exhibited an areal capacitance of 47.2 mF/cm², which increased to 183 mF/cm² upon Erbium addition and reached 299 mF/cm² under light irradiation of the composite suspension (Figure 1).[1]

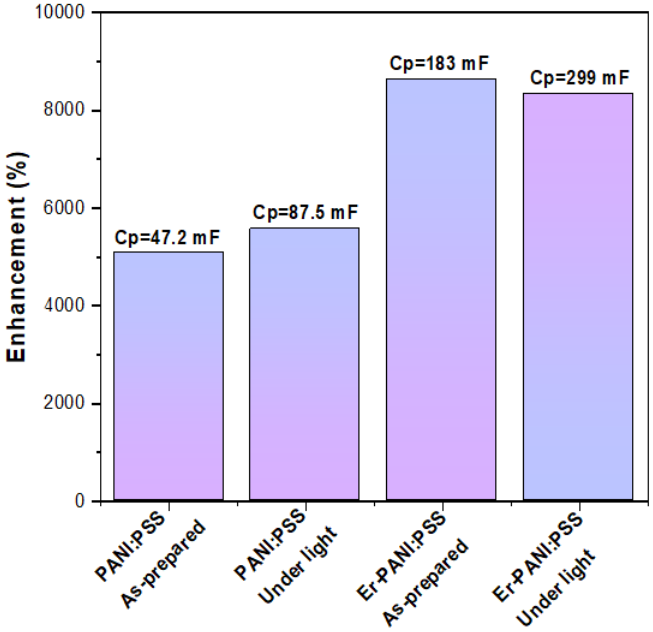

Figure 1. Areal capacitance of different systems, calculated from CV.

Keywords: Polyaniline Quantum Dots, Energy Materials, Erbium Ions.

References

[1] Ennour,i M.; Svoboda, J.; Morávková, Z.; Hromádková, J.; Tomsik, E. Harnessing Light in Tandem: Advanced Erbium-Polyaniline QD Composites for Next-Generation Energy Storage, *Nanoscale*, submitted.