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Organized by: Y. Yang, S. Meng, A. Yamada, Y. Sun
Poster Session
10:00 – 12:00
435. Graphene-based nanocomposites anode materials for lithium-ion batteries in electric vehicles, K. Kim, Kim, K.
436. Toward high carbon density energy storage lithium-ion batteries: Particle density measurements of layered LiCoO2, LiNiO2 with 0 ≤ x ≤ 1, K. Mukai, K. Nakano
437. Effect of solid phase in fusion and sintering performance of polycrystalline solid oxide fuel cells, R. SUGASA, S. NAGATA, H. MAKI, M. HOSHI
438. Chemical reaction of organic carbonate on Li anode surface in Li-air battery based on anodic oxide layer films, S. TALLI, G. D'AMATI, T. ZAVATTONI, S. TAIWAN
439. Exploring of Mn-base oxides micro/nanostructured as anode materials for advanced lithium-ion batteries, W. JUN, J. XIAO, Y. GAO
440. Synthesis and characterization of ordered mesoporous electrode materials for lithium-ion batteries, X. ZHANG, H. KEE, L. JIA, P. PARK, J. Kim
441. Novel lithium ion conducting oxide based on SrTiO3, M. LAMM, K. SUZUKI, M. HIRAYAMA, H. KANO
442. Effects of sulfur electrolyte additives on solid oxide electrolyte interfaces of lithium-ion batteries, S. KIKUKAZU, C. YOGI, T. SAKANO, K. AKUNA, M. KATAYAMA, Y. INADA, T. OKA
443. Li4+Li+MnO2(slit) as a positive electrode材料 for rechargeable lithium-ion batteries, J. PARK, S. MYOUNG
444. Lithium treatment to produce polycrystalline thin-cathode lithium cathode with a lithium-rich layered rocksalt structure, M. HIRAYAMA, Y. KAWANO, Y. ZHANG, H. KANSAKA
445. Effects of K-ion doping on electrolytic performance of polycrystalline ceria based cathode materials for Ni-air batteries, J. EUN, M. KIM, S. KIM
447. Lithium-ion electrochemical characteristics of nano silicon/polymer/carbon composite anode for lithium-ion battery, J. LEE, S. LEE, J. PARK
448. Eye-inspired radical scavenger: Polydimethylsiloxane as an electroactive additive for improved cycle performance of Li-air battery, Y. KIKAI, H. KMIYA, K. HIRAOKA, T. YAMASHITA
449. Lithium-ion conduction with Argyrodite type structure in the Li-Ga-Fe system, Y. KIKAI, K. SUZUKI, M. HIRAYAMA, R. KANO
450. Injection of sodium and magnesium into boron carbide/boron materials, H. HIGUCHI, M. KAWASUJI
451. Green, large-scale synthesis of hierarchical nanostructured assembly of polyaniline for supercapacitor applications, D. GP
452. Nickel-manganese oxides on MWCNTs/CNF substrate as supercapacitor electrode, D. Li, X. ZHANG, H. WANG, Y. HUANG
453. Unique nano-architecture electrodes for high-performance supercapacitor, G. O. KHANJANI, J. PARK
454. Reaction and transport of alkali metal on SrO2ZrO2 composite, synthesized by solid state phase deposition method, Y. SHIBATA, H. MIKI, T. KOBAYASHI, W. KAWABE
455. Electrochemical oxygen evolution by polyaniline-manganese compounds, T. TSUKAMOTO, H. IM
456. Efficient electrochemical reactions for energy storage devices based on conducting polymers, T. ICHI
457. High energy-density proton redox capacitor using quinonic compounds coupled with Ti, T. TAMAI, D. KOMUCHI, M. MORI
459. High contrast and complementary electrochemical device based on a WO3 film and an organic solution in a highly absorbing from the visible and the infrared, D. WANG, M. LI, J. ZHENG, C. XU
462. Destruction of graphene by polyaniline using an enhanced photocatalyst for high-performance anodes in electrochemical applications, J. Y. LEE, P. KIM, W. KIM
463. Cu2O/nanostructured catalysts with enhanced performances in energy storage, Y.-J. Song, S. LI, L. CHEN, W. FANG, F. LI
465. Energy storage by proton-coupled electron transfer reactions of fluocomplexes, D. MATSUOYA, H. OSSAWA, M. HAGA
467. Porous graphene structure from electrochemical vapour deposition and supercapacitors, H. SONG, H. JANG, J. KANG
468. Performance enhancement of planar perovskite solar cells by electro doping of electron transporting layer, M. S. BAO, W. JI
469. Membrane-free wastewater electrolysis cell for decentralized molecular hydrogen production: Current and energy efficiency, K. CH, M. HOFMANN
471. Creation of chiral ionic plastic crystals and photoresponsive materials, T. YASUDA, T. MATSUBO, K. KIMIZUKA
472. Determination between processing condi-tions, morphology, crystal orientation, and efficiency of C60/Pyridine based por-catalytic solar cells, S. BAE, S. HAN, T. SHIN, W. J., XING

Hyatt Regency Waikiki
Kou Baimin
Artificial Photosynthesis: Bio-inspired Chemistry for Solar Fuel Production (427)
8:00 – 9:30. Mechanism of light-induced water splitting – learning from nature’s ingeriuos concept, W. LUBA
3:410 – 4:30. Molecular electrocatalysis: Such stuff as dreams are made on. M. BONCHESS

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Direct Exfoliation of Graphene using PSSA–g–PANI as a Surfactant for Supercapacitor Electrode

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Introduction

- Common fabrication methods of graphene/polymer composite for supercapacitor electrode
  - Electropolymerization
  - In-situ polymerization

Electropolymerization

- Electrochemical exfoliation

Disadvantages

- Complicated experimental steps
- Long time for fabrication of composites
- Using graphene oxide containing many defects as a precursor

Direct exfoliation methods of graphene

- Solvents for graphene exfoliation
- Surfactant for graphene exfoliation

Advantages

- Production of high quality graphene
- Simple and easy fabrication
- Low cost

PSSA-g-PANI as a surfactant for graphene exfoliation

- Water-soluble moiety
- Self-doping moiety

- Soluble in ethanol due to water-soluble moiety
- π–π interaction of PANI with graphene

Objectives

- To fabricate graphene/polymer composite using poly(styrenesulfonic acid graft aniline) (PSSA–g–PANI) as a surfactant.
- To investigate electrochemical properties of the composites as a supercapacitor electrode.

Results

Fabrication of graphene/PSSA-g-PANI composite via direct exfoliation

Sample preparation

1. 100 mg of graphite and 100 mg of PSSA–g–PANI are dispersed in 10 ml ethanol via bath-type sonicator for 8 hours.
2. The dispersed solution is centrifuged for 60 min at 2000 rpm and decanted.
3. The composite is obtained by evaporation of solvent in supernatant.
4. The composite is dried at 30 °C under vacuum for 24 h.

Microscopic images

- SEM images
- TEM images

Raman spectra

- (a) Confirmation of vibrational bands of the composite (GP), graphite and PSSA-g-PANI
- (b) Single broad peak of 2D band in GP

Electrochemical properties

- The maximum specific capacitance of graphene/PSSA-g-PANI composite: 767 F g⁻¹ at 0.5 A g⁻¹ based on galvanostatic charge/discharge test and 82% retention of the specific capacitance after 1000 cycles.

Conclusions

- graphene/PSSA–g–PANI composite is fabricated via direct exfoliation method.
- The composite exhibits the excellent specific capacitance of 767 F g⁻¹ at 0.5 A g⁻¹.
- The composite retains 82% of its initial capacitance after 1000 cycles indicating high electrochemical cyclic stability.
Fabrication of graphene/poly(styrenesulfonic acid-g-aniline) composites for high performance supercapacitor electrodes

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Polyaniline (PANI) as a potential candidate for supercapacitor electrode has high theoretical specific capacitance of about 2000 F/g. However, PANI itself suffers from poor solubility in common solvents, which restricts fabrication of supercapacitor electrodes directly from PANI. In our previous report, we synthesized a water-soluble and self-doped conducting polymer, poly(styrenesulfonic acid)-graft-polyaniline (PSSA-g-PANI), to overcome the solubility problem of PANI. When PSSA-g-PANI is added into graphite in ethanol, it is realized that the graft copolymer exfoliates graphite into graphene layers to form in-situ composite of graphene/PSSA-g-PANI, because PANI in PSSA-g-PANI is strongly physisorbed onto graphene surface via strong $\pi-\pi$ interaction while PSSA in PSSA-g-PANI enhances the solubility in ethanol. To the best of our knowledge, this is the only PANI/graphene composite fabricated by direct exfoliation method. Compared to other fabrication methods for PANI/graphene composites such as in-situ polymerization and electrodeposition, the direct exfoliation method provides high quality of graphene layers without degrading the sp$^2$ structure because graphite is directly used as a precursor without chemical treatment, and also minimizes the fabrication step by simply mixing graphite and the polymer. As a consequence, PSSA-g-PANI/graphene composite is easily fabricated by a solution process and used directly for supercapacitor electrodes. When the capacitance of the composite was measured by the Galvanostatic method, the composite exhibits high specific capacitance of 767 F/g at 0.5 A/g, which is among the highest value of supercapacitor electrodes based on PANI/graphene composites. This high value is attributed to high specific area of graphene and high pseudo-capacitance of PANI. Furthermore, PSSA-g-PANI/graphene composite retains 82% of its initial capacitance after 1000 cycles, indicating that the composite has high electrochemical stability.