

Review on Nano Particle Based Li Ion Batteries

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Abstract - Li ion batteries have applications in nanotechnology. Here in this paper we were mainly focused on nonmaterial's such as CNTs, silicon thinfilms, coaxial MnO₂/carbon annotated array electrodes, self assembled TiO₂ graphene and li paper batteries to improve the performance of nanobatteries and storage.

Keywords - Li ion batteries, CNT, thinfilms, Array electrodes, TiO₂ graphene.

I. INTRODUCTION

Lithium ion paper batteries could bring an unprecedented opportunities for consumers by the integration of electronics comes into existence [1-3]. These devices are manufactured by roll-roll printing process due to its low cost and properties such as paper thin, flexible and light weight. For the integration of an easy system, a power source is directly merged onto the paper. The power sources are mainly required for the functioning of paper electronics. . excluding this, secondary Li particle batteries area unit the key components in transferable natural philosophy owing to their high power and energy density and long life[4].

At present carbon based materials are ranging from 0.1-10micro .So it becomes an alternative for lithium storage in Li-ion batteries. By the recent breakthrough of new carbon crystalline forms with dimensions of 1-100nm, it seems that there may be a paradigm in carbon based electrode materials. Nanotubes provides high mobility to ion exchange process ,a base for dynamic response batteries followed by Lithium intercalation .For example ,there is a possibility to charge single wall carbon nanotube up to one lithium for every three carbons are higher[5].

Li ion batteries mainly used for portable electronics because of high energy and power density and for other applications such as power tools, vehicle electrification. For the improvement of energy density for both anode and cathode an extensive research has been carried out to find new electro materials and new electrode structure designs. In that extensive research silicon anode shows better result compared to graphite anode, because silicon has high known capacity than graphite i.e. quite ten times the worth of this industrial graphite anode. During Li cycling intrinsic volume expansion and contraction of Si takes place and causes rapid capacity fading and limits its wide applications. Various approaches have been carried out to overcome this

issue, including the use of Nano sized active materials (6-12). In order to create Li batteries with improved Capability and power capabilities, concentrically nano wires/ nanotubes of multiple materials with specific electro-chemical properties got to be fancied. Here, MnO₂, carbon nano tubes (CNT's) are regarded as high performance electrodes of Li-batteries in the synthesis of hybrid co-axial nano tubes. CNTs have outstanding electrical properties except for their high chemical stability, high ratio, robust mechanical strength, and high activated expanse, are engaging conducting materials in energy storage devices, like capacitors, fuel cells, and Li batteries(13-19).

Careful engineering of hybrid concentric conductor material having each high storage capability metal chemical compound and extremely conducting CNTs can result in increased Li storage properties. The tubular morphology offers a novel combination of high body and low internal resistance. The work is aimed to extend the electronic physical phenomenon and Li storage capability of MnO₂ nanotubes by using coaxial nanotubes with MnO₂ nanotubes within the outer shell and extremely conducting CNT within the inner core. Carbon nanotubes (CNTs) will function one-dimensional nanomaterials and that they are often created into 2 forms of CNTs—single-walled nano tube (SWCNT) rolled up by one-layer graphene and multi walled nanotube (MWCNT) rolled up by multilayer graphene.

CNTs have glorious mechanical, electrical, and chemical properties because of their lightweight and ideal association in their hexagonal shape structure. In recent years, with the progress within the analysis on CNTs and Nano materials, the prospect of wide application of CNTs is rising (20-23), owing to its glorious electrochemical properties, (106 Sm⁻¹ at 300 K for single walled CNTs (SWCNTs) and >105 Sm⁻¹ for multiwalled nanotubes (MWCNTs)), tenuity, high rigidity, and high lastingness . Both the anode material and also the conductive additive within the composite electrodes of CNTs are employed in

Li ion batteries. TiO₂ has many applications in the field of conductive coating and effectively thick, low cost and environmentally friendly material. In Li electrochemical deposition the insertion/extraction of Li is stable from TiO₂ which leads to wide energy storage. The properties of li-ion can be enhanced by introducing the hybrid nanostructured electrodes with nanophases additive (24-32).

II. EXPERIMENTATION

The coaxial nanotube structures have been set up by a mix of straightforward vacuum penetration and synthetic vapour testimony procedures through a layout approach. MnO₂ nanotubes are first created by vacuum penetration inside the channel of financially accessible AAO formats. Nano pore distances across of ~200nm and length of ~50µm, which is trailed by developments of CNTs utilizing synthetic vapor statement (see supporting information for technique and blend, area 1s) the example was plasma scratched for 30 min to evacuate the undefined carbon layer that structure amid substances are vapour affidavit. A layer of Au film (100 nm) was sputtered onto one side of the layout which fills in as the present gatherer for the a node.

The MnO₂/CNT mixture coaxial structures are then discharged from the alumina formats by dissolving the layout in 3 M NaOH answer for 1hr. The nearness of Au film holds the coaxial half breed structures from falling, after nanotubes was described by checking electron spectroscopy (FEI quanta 400 ESEM FEG) and vitality dispersive X-beam spectroscopy (EDX). The powder X-beam diffraction designs were gotten by a Rigaku D/max ultima II utilizing Cu Kα radiation. For the X-beam photo electron spectroscopy (XPS) examination, PHI Quantera XPS was used. Flexible movies of MnO₂/CNT coaxial nanotubes acquired after the expulsion of formats were specially utilized as anode in the lithium battery [33].

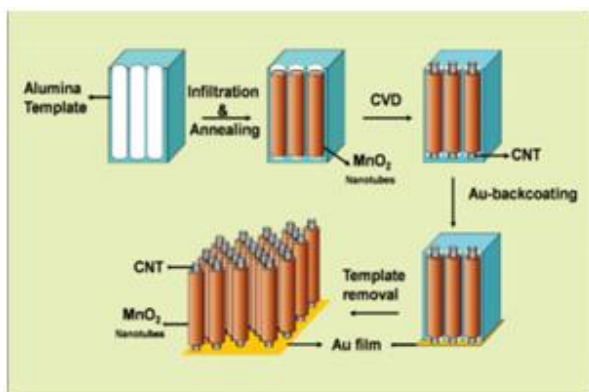


Fig. 1. Schematic outline demonstrating the manufacture of MnO₂/CNT half breed coaxial nanotube exhibits inside AAO format utilizing a mix of straightforward vacuum penetration and substance vapor statement techniques.

A thin layer of gold (~100 nm) was sputter covered to go about as present authority for the terminals [33].

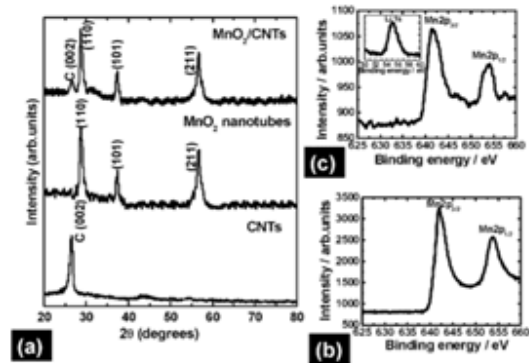


Fig. 2. (a) X-beam diffraction examples of MnO₂/CNT coaxial nanotubes, MnO₂ nanotubes, and CNTs. XPS spectra of MnO₂/CNT coaxial nanotubes (b) prior and then afterward (c) first lithium release process. Arrangement of manganese metal and Li₂O amid the underlying lithiation process has been affirmed utilizing XPS [33].

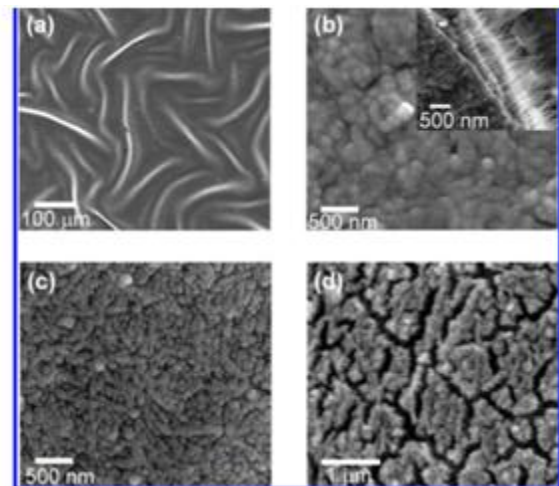


Fig. 3. (a) SEM picture of CNT-Si film after 10 cycles. Strain initiated swelling can be observed. (b) Zoomed-in SEM picture of film in (a). Inset is a SEM picture of a broken edge. (c) SEM picture of CNT-Si film after 20 cycles. (d) SEM image of CNT-Si film after 40 cycles.

Films On SS CNT 500 Mesh:- To frame a standing CNT layer on SS work, a 500 work was dipped into a CNT ink, taken out, and dried in a stove at 65 °C. The SS work bolstered CNT film was then used to be deposited with Si. Free-Standing CNT and CNT-SiNP Thin Films:- An aggregate of 10 mL of CNT ink was spread out onto a tempered steel substrate with the Meyer pole covering strategy. The wet film was then gradually dried at 60 °C to abstain from gurgling. At that point silicon was kept onto the detached CNT film utilizing the CVD procedure. For CNT-Si NP ink, 1.6 mg/mL CNT and 10 mg/mL Si NP were scattered in water with 10 mg/mL SDBS. The scattering was then test sonicated for 10 min before

utilize. The creation methodology for the CNT-Si NP films were the same as those for the previously mentioned CNT films[34]. Synthesis Procedures:- In a run of the mill arrangement of rutile TiO₂-FGS hybrid materials (e.g., 0.5wt % FGSs), 2.4 mg of FGSs and 3 mL of SDS watery arrangement (0.5 mol/L) were combined. The blend was weakened to 15 mL and sonicated for 10-15 min (Branson SoniferS-450A, 400 W). A 25 mL part of TiCl₃ (0.12 mol/L) watery arrangement was included into as-prepared SDSFGS dispersions while mixing.

At that point, 2.5 mL of H₂O₂ (1wt %) was included drop wise taken after by deionized water under incredible mixing until achieving an aggregate volume of 80mL. Additionally, 0.8, 26.4, and 60 mg of FGSs were utilized to set up the cross breed materials with 0.17, 5, and 10wt% FGSs, separately. Rutile TiO₂-CNT (0.5wt % carbon nano tubes) half breed materials were readied utilizing corresponding single-divider CNTs (2.4 mg) as indicated by the above method. In an average readiness of anatase TiO₂-FGS cross breed materials (e.g., 2.5wt % FGSs), 13 mg of FGSs, and 0.6 mL of SDS watery arrangement (0.5 mol/L) were blended and sonicated to set up a SDS-FGS scattering.

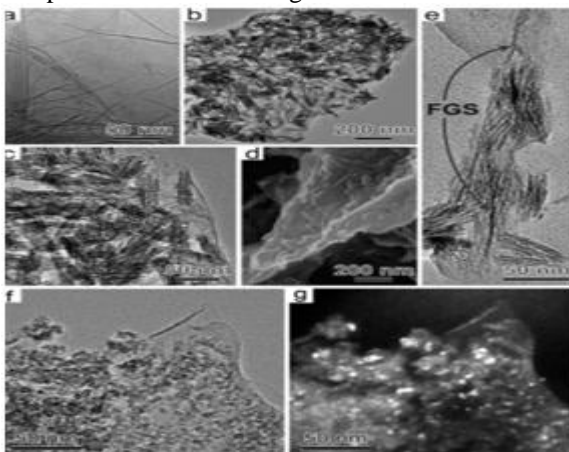


Fig.4.(a) TEM picture of FGSs. (b, c, and d) Low-and high-magnification TEM and SEM pictures of the self-assembled rutile TiO₂-FGS crossovers, separately. (e) Cross-area TEM picture of rutile TiO₂-FGS mixture indicating nanostructured rutile TiO₂ lying on the FGS. (f) Plane-see TEM picture of anatase TiO₂-FGS half and half nanostructures. (g) Dark-field TEM picture of the anatase TiO₂-FGS cross breed nano structure[35]

A 25 mL segment of TiCl₃ (0.12 mol/L) fluid arrangement was included into as-arranged SDSFGS dispersions while mixing, trailed by the option of 5 mL of 0.6 M Na₂SO₄; 2.5 mL of H₂O₂ (1wt %) was then included drop wise taken after by expansion of deionized water under energetic blending until achieving an aggregate volume of 80mL. All of these subsequent blends were additionally mixed in a fixed polypropylene flagon at 90 °C for 16 h. The has tens

were isolated by axis taken after by washing with deionized water and ethanol. The centrifuging and washing forms were reshaped three times. The item was then dried in a vacuum stove at 70 °C medium-term and consequently calcined in static air at 400 °C for 2 h. The warm gravimetric investigation (TGA) showed roughly 50 wt % rate loss of FGSs amid calcination in air at 400 °C for 2 h (Figure S6 in SI). Measure level of graphene in the half and half materials is correspondingly standardized, which is reliable with TGA of the cross breed materials[35]

III. CONCLUSION

In conclusion, here we discussed about various materials used in li-ion batteries in order to meet with our advancement of technology. The materials used here are CNT Si thin films, co axial MnO₂/carbon nanotube array electrodes, li-ion paper batteries and self assembled TiO₂ graphene. By using various materials as discussed above we can increase the storage, size and many other properties of li-batteries. These li-ion batteries has many applications in nanotechnology as well as in many other applications.

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