



Al-C Nanocomposite for Advance Power Generation System

Shyam H. Vasvani¹, Chirag R. Savaliya¹, J.H. Markna¹

¹Department of Nanotechnology, V.V.P. Engineering College, Rajkot -360005-India.

Abstract- In the field of power generation especially in Li-ion like rechargeable batteries are now hands on its limitation with the help of Nanotechnology. Nanocomposite like Al-C blend materials has been effective by high-energy ball milling technique. The electrical measurements demonstrated that the Al-C composites have profoundly improved electrical performances in analogy mutually Al, Al-C as an anode. For concrete illustration, this improved electrical resistance could be concerning the alloying establishment of Al with C and the buffering effect beside graphite matrix with the help of Laser-arc deposition technique. This suggests that the Al-C building a whole has a potential mishap to be developed as an anode accessories for lithium-ion batteries. With the help of simple method of transforming micrometer-sized Al and C powders into a new nanocomposite modified with carbon or Carbon nanotube (CNT) by the alloying reaction of Al and C to form the Al-C phase and the reaction of the Al-C phase to synthesize the Al-C Nanocomposite was developed using a Laser-Arc deposition technique. These type of nanocomposite are widely applied in various type of electrical application.

Keywords- Al-C Nanocomposite; Resistance; Power generation; Efficiency

I. INTRODUCTION

In the field of power generation rechargeable solid-state batteries like nickel-cadmium (Ni-Cd) or Li-ion, can be considered as the soul of the transferable power source market. With the help of advanced technology, it will easy to improve this gadget and decrease its limitation. Nanotechnology is a well-known now in the field of electronics, in that this advance technology also improve the efficiency of the rechargeable battery. With the help of porosity like property of carbon material is apply in the electrochemical storage of energy. Carbon is a very attractive material for the electrochemical application. However, this property of carbon strongly depends on the bonding with other material, it exhibits rich electrical property from donor to acceptor state. [1]

Thermally and electrically conductive polymer composites are used mostly in the electronics, automotive, and aerospace industries to disband heat and prohibit the buildup of static charge. Carbon black or copper snoop are actually used as fillers; nevertheless, the valuable loadings required routine have a detrimental chance on the automated properties of the matrix. Therefore, steep aspect capacity and very conductive materials a well-known as single- and multi-walled imitate nanotubes (SWNTs and MWNTs) are regarded as ambitious fillers, being they bounce provide electrical percolation at absolutely low concentrations [2]. To a generation, MWNTs alternative than SWNTs have been predominantly used as conductive fillers what is coming to one to their ebb cost, outstrip availability and easier dispensability. However, the potentially higher intrinsic electrical and thermal conductivity of SWNTs should certify a by the same token reduction in the filler casual required for a subject to enhancement in the building whole properties.

II. DEPOSITION:

To prepare Aluminum-Carbon layer coating one of the successive technique known as Laser-Arc deposition technique [5]. Main Advantage of Laser-Arc deposition technique is deposition of different material with high efficiency, high precision, and good quality control. This process is described in detail with Figure.

First of all, evaporation carried out with the cryogenic pump system, then the arc of plasma is propagated onto the cathode or target material placed in the chamber. Laser Source is used to ignite the vacuum after arriving at the anode. This pulse length is about 100 nanosecond (ns) in order to its magnitude. This deposition process carried out at substrate below 100°C. For the preparation of a smooth layer of the structure, it is advisable to make a cylindrical disk of different material. This control of method makes a homogeneous erosion of roll. A benefit of the laser-arc technique are making the film besides of pure metal such as Aluminum, hard porous carbon and Al-C multilayers can be deposited without any reduction in the deposition rate.

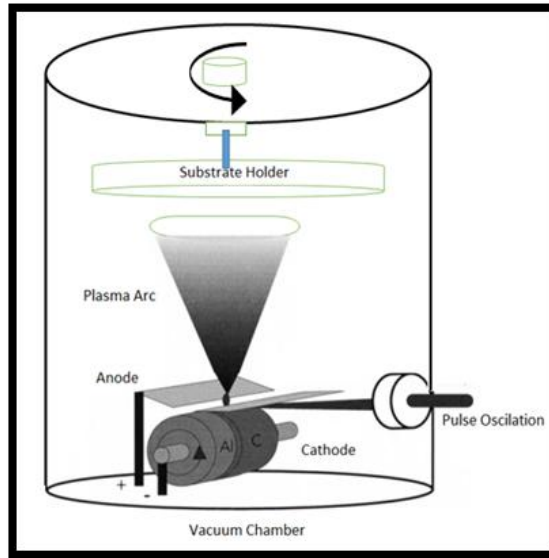


Figure 1. Laser-Arc deposition technique for deposition of Al-C Nanocomposite

III. EXPERIMENTAL DETAIL:

Experimental study means of the electrical obstruction of abandoned fabricate Carbon composite showed an electrical conflict of the decision of 10^{-6} and 10^{-4} Vcm [3, 4]. The simulate Carbon powder has, in any position, a decline electrical conductivity than aluminum. In addition, if the carbon nanotubes are agglomerated at the Al fodder boundaries, they boot construct a fairly forage boundary phase which will restore the minority of the require carrier at the grain boundary, hereafter reducing the conductivity. The carbide phases, which are furthermore poorly conducting, and the porosity, which is larger than simple Al, can also persuade the electrical resistivity of the composites.

III-A. I-V CHARACTERISTIC

10%C, 20%C, and 50%C imitate Carbon powder and 35g aluminum grime was homogeneously interwoven by common laborer grinding for preferably than about half an hour respectively. The mixtures were hot-pressed at about 700 K under a charge of 20 to 25 Mpa for preferably than 30 min. The hot-pressed samples mutually a term of cross measure 240 mm were spark-cut directed toward pieces for contrasting measurements.

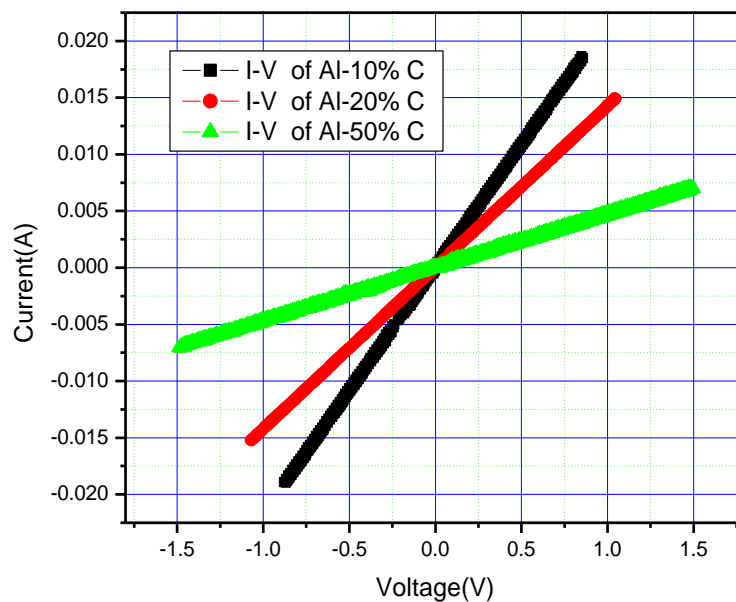


Figure 2. I-V Characteristic of different mixture of Al-C Nanocomposite

Composite	Al	Carbon	Resistance
Al+ 10% C Nanocomposite	90%	10%	46.45271
Al+ 20% C Nanocomposite	80%	20%	70.57213
Al+ 50% C Nanocomposite	50%	50%	211.3519

Table 1. Electrical resistivity of thin pieces of the samples at room temperature

The results of the electrical resistance measurements (Fig.2) are interesting. From this, the electrical resistivity and resistance concentrated linearly as the atmospheric condition decreased, which is typical give insulator behavior. It is already studied that at roughly 80 K there is an abrupt depart (90%) in the electrical resistivity of the Al-C Nanocomposites [8]. Below this transition temperature the resistivity excess at the directly of ‘zero resistance’ entire to the helium temperature (4.2 K). Such a wonderment resembles a superconducting transition [8].

III-B. X-RAY DIFFRACTION (XRD):

X-ray diffraction (XRD) were used to examine the structure of carbon material. This plan was used to notice the process of imitating Carbon material, the selection of imitating Carbon powder and disparate phases in the fabricate nanotubes used were produced in our composites. The dimensions of samples for measuring laboratory individually catalytic impairment of the propylene. In this data, Al-C Nanocomposite gives the different peak with added the mixture of carbon material which can easily notice in Fig.3

However, X-ray diffraction has shown that the body material mainly consists of Al and fabricate Carbon powder (Fig.3), which patent that the at variance phases are pretty constituents of the composites. The observed lattice parameter of Al is as a matter of fact close to the reference worth of 0.40491 nm[7]. Further experiments on the motor driven properties of the composites are imminent in the term to confess the abrupt drop of electrical resistivity at so valuable a temperature.

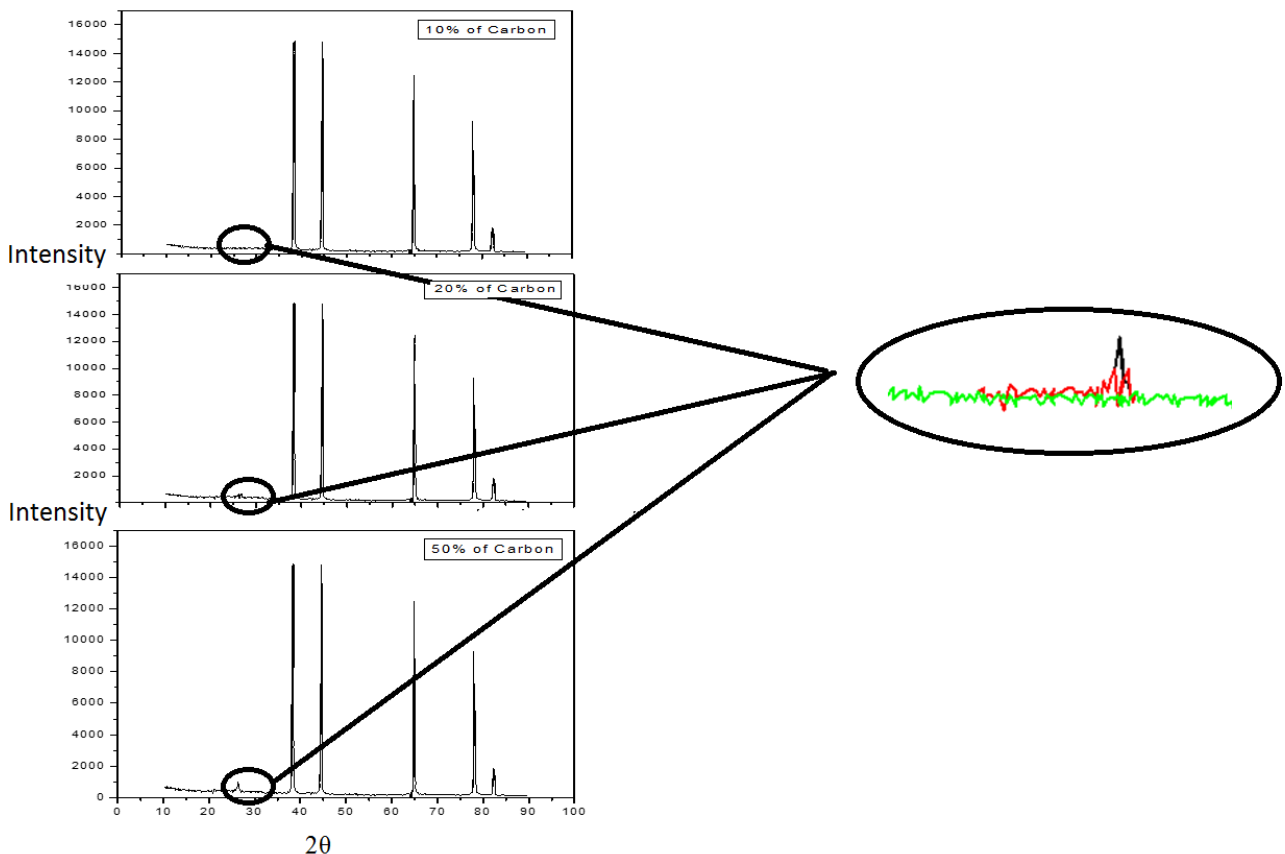


Figure 3. XRD pattern of different mixture of Al-C Nanocomposite

VI-RESULT AND DISCUSSION

Figure 2, shows that the electrical resistance of Al-C Nanocomposite with a different proportional ratio of Carbon. With this comparison of I-V characteristic of this experiment shows the insulating behavior which can help in the replacement of anode material in Li-ion battery. Figure 3, shows the XRD patterns of the Al-C Nanocomposite (10%C, 20%C, 30%C) respectively. With micrometer-sized Al and C powders, the Al-C was prepared by mechanical alloying, in which all of the peaks corresponded to Al-C and no other phases were detected. Additional mechanical alloying with carbon was performed, in which the XRD peaks displayed an amorphous phase and only a main Carbon peak of with a reduced crystallites appeared. This behavior shows that with the mixture of Al-C Nanocomposite gets chance its electrical property with enhancement of Carbon based ingredient.

V-CONCLUSION

With the help of nanotechnology based simple method for transforming micrometer- Sized Al and C powders facing a new Nanocomposite modified mutually carbon by utilizing the alloying and other porous material using the technique of Laser-Arc deposition technique. With the given result of I-V characteristic and XRD pattern, we conclude that Al-C Nanocomposite shows good electrochemical property so that Al-C electrode confirmed its potential as a new alternative anode material for Li-ion batteries. Al-C Nanocomposite will support their use in many other applications in the power generation and storage also.

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