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Comparison of Doping Graphite and Multi-Walled Carbon Nanotubes with Ag by Photo-Deposition Method

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Abstract:- Ag was impregnated with MWCNTs and Graphite to forming binary composites (MWCNT-O:Ag) and (GO:Ag) by using photo-deposition method. The MWCNT and G were activated by H2O2/NH4OH (1:1) before impregnated with 1% Ag to enhance the interaction activities of MWCNTs and Graphite oxide with Silver respectively. The binary composites were characterized by analysis the structure with X-ray diffraction. The results shows that MWCNT-O was more active then GO to accept Ag nanoparticles with different phases Ag, AgO and Ag2O.

Keywords:- *GO, MWCNT-O, XRD, Photo-Deposition.*

I. INTRODUCTION

Carbon nanomaterials CNMs represent the common nanomaterials which is synthesized in huge quantities and sensitive qualities due to abilities to use it in variant applications. The most important CNMs [1] were graphite and graphene and fullerenes and carbon nanotubes CNTs which include single SWCNTs , few FWCNTs and multi walled carbon nanotubes MWCNTs [2] . CNMs were synthesized by many techniques such chemical vapor or physical deposition, Laser ablation, Arc-discharge and flame method [1-3] . The applications that used with CNMs were may use in pristine or modified after functionalized with oxidation reagent [4]. The modification include impregnated or doping with metals or semiconductors to forming binary and ternary composites such TiO2 and Pt [5] . Silver Ag nanoparticles mostly used to make modified for graphite or CNTs which succeed to enhance the physical and chemical properties for the new mixture. The enhancement influence directly with the types of interaction between Ag with CNTs or Graphite and the ratios \surface area for the impregnated surface which represent by sheets of carbon for sp2 hybridization. Thus may be choosing suitable technique for doping maximum value of Ag with minimum value for losing active site by agglomerations, ploy important roles in this sections. In this work the techniques for doping Ag with MWCNTs or G was photo-deposition by UV-light as sources of activation in nitrogen atmosphere for Methanol/H2O solution. The efficiency of precipitation and compare were done by using X-ray diffraction method.

II. EXPERIMENTAL

- *Materials*

Multi-walled carbon nanotubes were purchased from ALDRICH. The MWCNTs are 95% carbon nanotubes with a mode diameter of 4.5 nm. from The graphite was purchased from FLUKE, silver nitrate ($AgNO_3$) salt and Ammonium hydroxide 37% was supplied by SIGMA-ALDRICH. Hydrogen peroxide (40%) was supplied by ALFA-AESAR.

- *Functionalization of Carbon Nanotubes*

The functionalized process for graphite and MWCNTs were done as reported in literature 4.Briefly, [4] 0.5 g of carbon material (MWCNTs, graphite) was placed in a 500 mL Conical flask equipped with a condenser, and 200 mL of H_2O_2 : NH4OH (1 : 1) was added at 10 ^oC for 1 h which activated under magnetic stirring. The mixture was sonicated for 2 h at 30 °C, and then heated to 70 °C for 8 h without stirring. The product were washed several times with distilled until reach to neutral, finally thermal treatment at 110^oC for 12h.

- *Synthesis of MWCNT-O:Ag and GO:Ag*

Figure 1 shows the process of synthesis two types of binary composites. Ag was deposited onto GO and MWCNT-O by photo-deposition method, when mixture of 50% aqueous ethanol solution with required amount of $AgNO_3$ was irradiation by 1.3 mW of VU-light. The deposition was accrued with irradiated for 6 hour at 40^oC, using a 200-W mercury lamp to produce MWCNT-O:1%Ag and GO: 1% Ag respectively.

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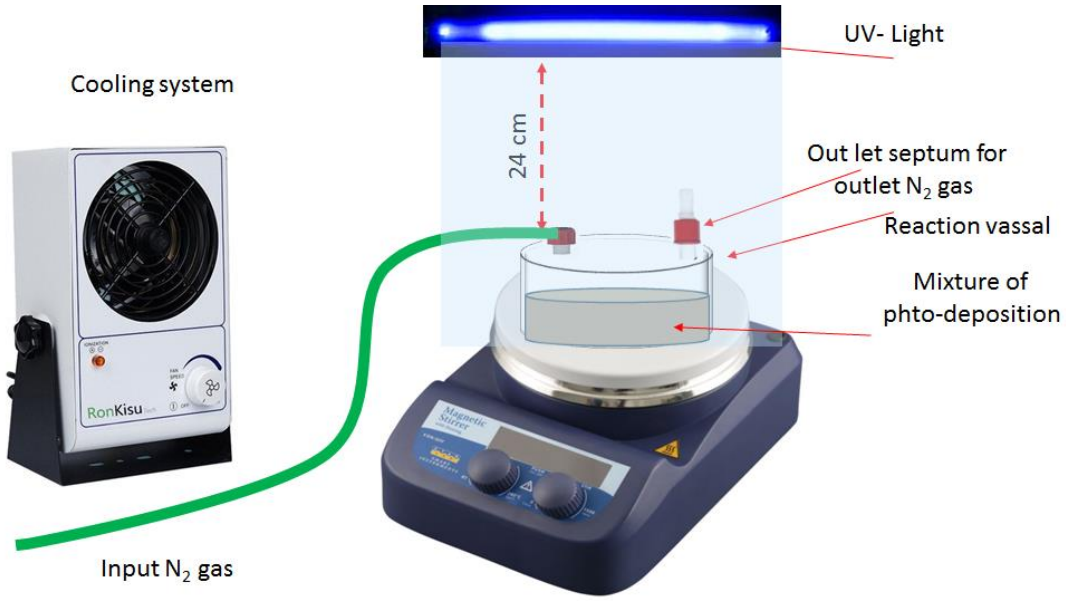

Fig 1:- Skim for the Photo-

III. CHARACTERIZATION AND RESULTS

The prepared samples was determined by X-ray diffraction (XRD) patterns with a (Riga Rotalflex-RU-200B) using Cu Kα radiation (wavelength 0.15405 nm) . The 2θ angular regions between 10 and 80° were explored at a scan rate of 5°/min. For all the XRD analysis, the resolution in the 2θ scans was kept at 0.02°.

XRD analysis were used to examine the efficiency process for photo-deposition of Ag onto MWCNT-O and GO with the same conditions of precipitation. Figure 2 refer to XRD analysis for GO before and after photo-deposition. Figure 2a shows only three peaks [6] at 29°, 43°, 55° and 79° which related to graphite oxide. Figure 2b refer to GO after photo-deposition with Ag when shows new two week peaks at 32° and 34° , mostly related to [7] Ag nanoparticles. The influence of Ag nanoparticles which photo-deposited onto the surface of GO was very week, may be for the low photo interaction between GO and Ag.

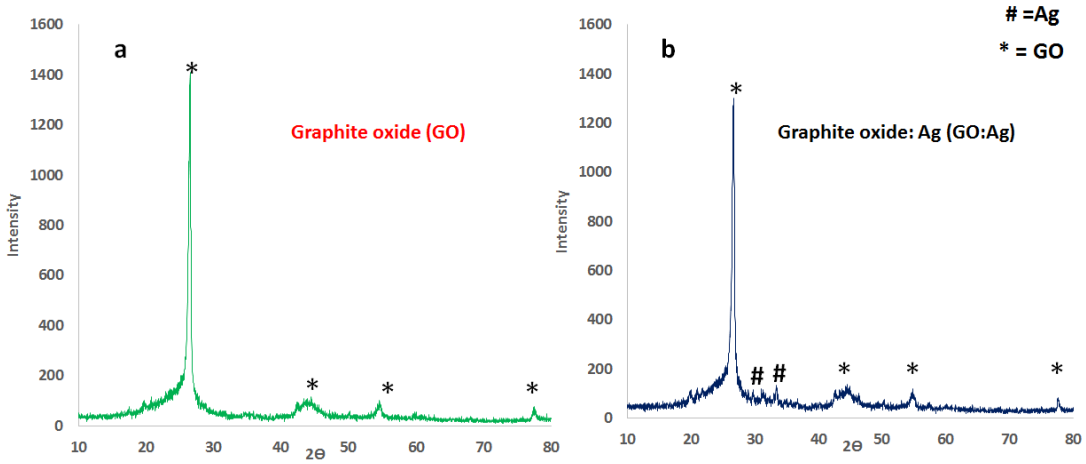

Fig 2:- XRD patterns for (a) graphite oxide GO and (b) GO:Ag

The nature of interaction of Ag was variance with MWCNT-O when appears with different activities. The behavior was shown many peaks at 16°, 30°, 35°, 44°, 55°, 63°, 72° and 78° [8] which related to three phases of silver Ag, AgO and Ag_2O [9]. the amazing in this properties can be represent in two phenomena : the first, is reduce the intensity of MWCNTs peaks after doping with Ag particles which may related to lower crystal properties of MWCNTs as compare with Ag [2]

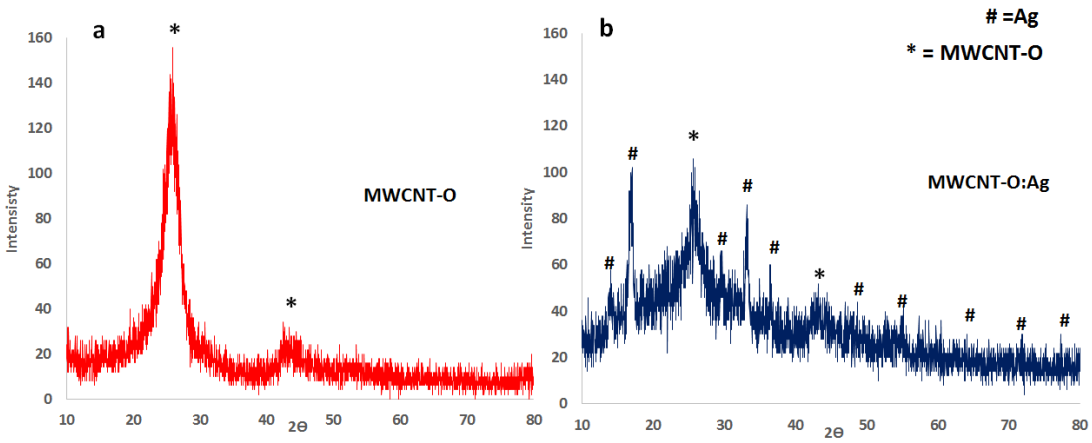

Fig 3:- XRD patterns for (a) MWCNT-O and (b) MWCNT-O:Ag

The second behavior was related to higher ratios for deposition Ag on the surface of MWCNT-O as compare with Go, however figure 2b and 3b shows that. Mostly the causes behind that can be related to two reasons: first, the influence of oxidation process was succeed to create more active site with reduce the agglomerate for MWCNT-O, while with GO was limited to reduce the particle size with few active sites. The second courses there is more surface area with MWCNT-O which provided more area to dispersion Ag which did not achieve with GO [10].

IV. CONCLUSION

The binary composites of Ag nanoparticles impregnated with GO, and Ag nanoparticles impregnated MWCNT-O have been obtained by one-step preparation method. The results of the two composites shows that the silver with GO and MWCNT-O hybrid show the highest abilities to impregnated within MWCNT-O while with GO was very limited. These results can be attributed to the influence of oxidation reagent (H2O2/NH4OH) when succeed to create many active site with reduces the agglomerate and increase the surface of reaction with MWCNT more than graphite. Thus the XRD analysis in this cause can be used to identify quantities and qualities efficiency of photo-deposition Ag nanoparticles with carbon nanomaterials.

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