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[Waleed, 5(10): October 2018] ISSN 2348 – 8034
DOI- 10.5281/zenodo.1445500 Impact Factor- 5.070

GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES

OPTICAL PRORATES OF WASTE PETROLEUM COKE POWDER (WPCP) TREATMENT BY ACIDS

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Abstract

The optical Properties of four samples that made from Waste Petroleum Coke Powder (WPCP) were discussed and compared with a control .One sample was left without treatment ,while three samples were treated by acids (HCL,HNO_3 and H_2SO_4:HNO_3mixtur) The control is Multi Wall Carbon Nanotubes sample (MWCNT).The optical characteristics of the prepared samples have been investigated by UV/Vis spectrophotometer in the wavelength range (288 – 500) nm..The maximum conductivity for all samples shift wards larger wave length where the maximum shift is at 480 nm for the sample treated with HCL .The absorption coefficient is larger compared to control and non treated one for samples treated with H_2SO_4:HNO_3, the other two have values less than non treated one .The refractive index is smaller for all samples at all values less than 485nm ,except at about 346 nm for (MWCNT) control sample ,where it has minimum value at this point .The dielectric constant is smaller for all samples for wave length values less than 450 nm ,however for more than 490nm samples treated with HNO_3 & HCL have larger values. This can be useful in electronic applications.

Keywords: *Waste Petroleum Coke Powder, Multi Wall Carbon Nano Tube, optical characteristics, optoelectronic applications.*

I. INTRODUCTION

Carbon nanotubes (CNT) powder normally is not pure, because it contains particles of carbonaceous materials (amorphous carbon particles, fullerenes and monocrystalline polyarmatic shells) and metal catalysts (generally compounded by Co, Ni or Fe). A large variety of methods such as physical separation, gas and liquid phase oxidation and combinational purification have been emerged to purify the CNT [1] . Purification processes involving physical and chemical oxidation of the CNT have been extensively investigate[1-4.] These processes are based on the fact that the oxidation temperature of carbonaceous particles is different from that CNT in air or oxygen [5]. However, persistent problem, associated with physical oxidation is that materials such transition metal catalysts that remain encapsulated in the wall structure can affect performance in many applications [1]. Physical separation is useful for the preparation of small amounts of purified coupons Gas-phase oxidation is not efficient for the removed of graphitic impurities and catalyst particles [2]. On the other hand liquid-phase oxidation is effective in removing both amorphous carbon and metallic catalyst particles. Oxidant common used in liquid phase are HNO_3 and mixture of H_2SO_4: HNO_3 [3] .The problem with this method is that the acid can react with the surface and insert functional groups, those can cut and open of CNT walls. Thus non oxidative acid treatments with HCL have been also employed to purify CNT [1].This work is devoted to study optical characteristics of petrol carbon waste after treated by acids .

II. MARTIAL AND METHOD

The control sample is Multiwall carbon nanotubes (MCNT) synthesized by LPCVD device, model (CV-6SLX) .The catalyst used was iron nanoparticles (Fe NPS) having purity 99.99% and size 3 nm They were annealed at 6500C for 40 minutes in a flow of 100 sccm of Argon and 50 sccm of hydrogen and then LPCVD growth was carried out by addition of 30 of acetylene for 40 minutes[12]. The samples of petrol waste in solid from were prepared by crushing it manually to be in a powder form. Treatment of the samples has been done with conventional acids treatments of non-oxidative and oxidative routs .The reaction rate of all treatments was 2g of carbon powder reacted with 100 ml of acid . For non-oxidative tested by HCL (36%) the samples have been left to interact for 5h. Oxidative process includes two types of treatment HNO_3 (63%) and a solution of H_2SO_4:HNO_3 (3:1). All samples were kept under reflux during 5h at temperatures between 45and 50°C (by using incubator model S150 shaking at speed 75).The samples are then removed from the heat path. After this treatment, the liquids were kept overnight in their flasks, and then were filtered with a Millipore membrane to send back powder. The filtered liquids were collected and the solid was washed with distil water until neutral pH equals 5. The sort solid was dried in an oven at temperature of 100°C for 12h under air to remove eventual moisture .The optical properties measurements shows that the absorbance is in the range from (288-500) nm .The optical characterization is done by using UV mini 1240 spectrophotometer made in a Japanese company called Shimadzu measures two types of fluids and can measure the solids in the form of slides .The device components are: light source – a cell sample – uniform wavelength – Scout – Screen. The powder samples were treated by N, NDimethyl for Hplc& spectroscopy.

III. RESULTS

The optical characteristics of the prepared samples have been investigated by UV/Vis spectrophotometer in the wavelength range (288 – 500) nm as shown bellow

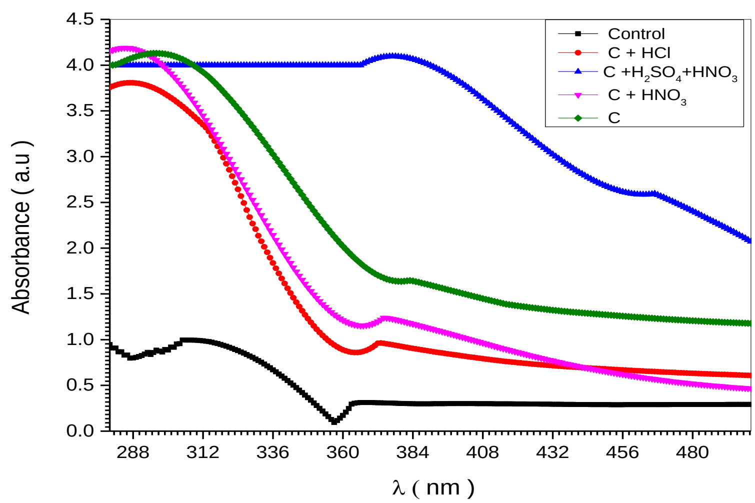

Fig (1)The optical absorbance spectra of Waste Petroleum Coke Powder (WPCP) ,treatment three samples by acids (HCL,HNO_3 and H_2SO_4:HNO_3mixture) and one is un treatment and compeer by control Multi Wall Carbon Nano Tube sample (MWCNT)

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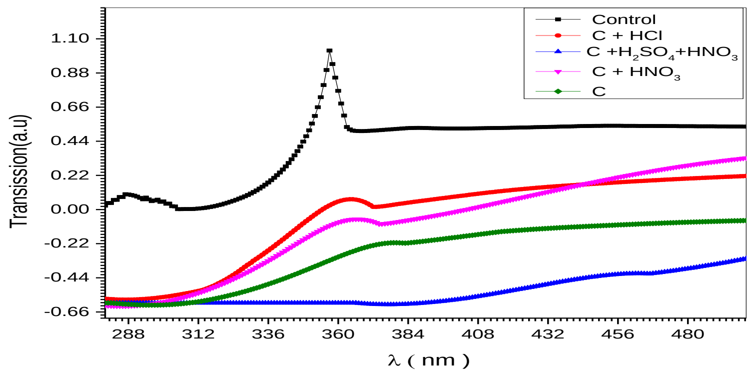

Fig (2)The optical transmission spectra of Waste Petroleum Coke Powder (WPCP) ,treatment three samples by acids (HCL,HNO$_3$ and H$_2$SO$_4$:HNO$_3$mixture) and one is un treatment and compeer by control Multi Wall Carbon Nano Tube sample (MWCNT)

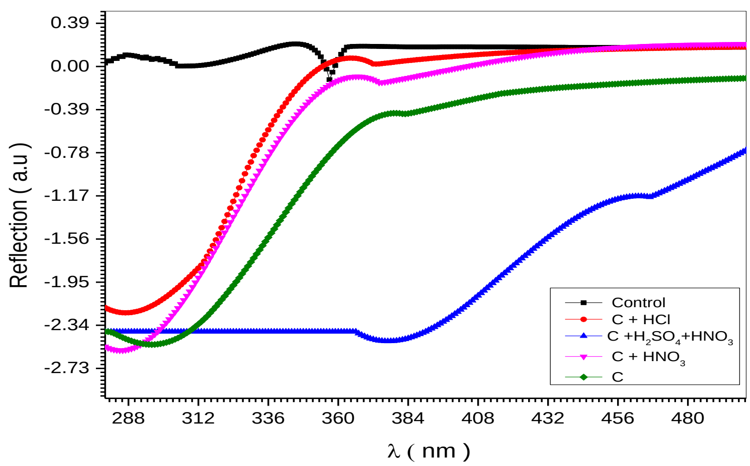

Fig (3)The optical reflection spectra of Waste Petroleum Coke Powder (WPCP) treatment three samples by acids (HCL,HNO$_3$ and H$_2$SO$_4$:HNO$_3$mixture) and one is un treatment and compeer by control Multi Wall Carbon Nanotube sample (MWCNT)

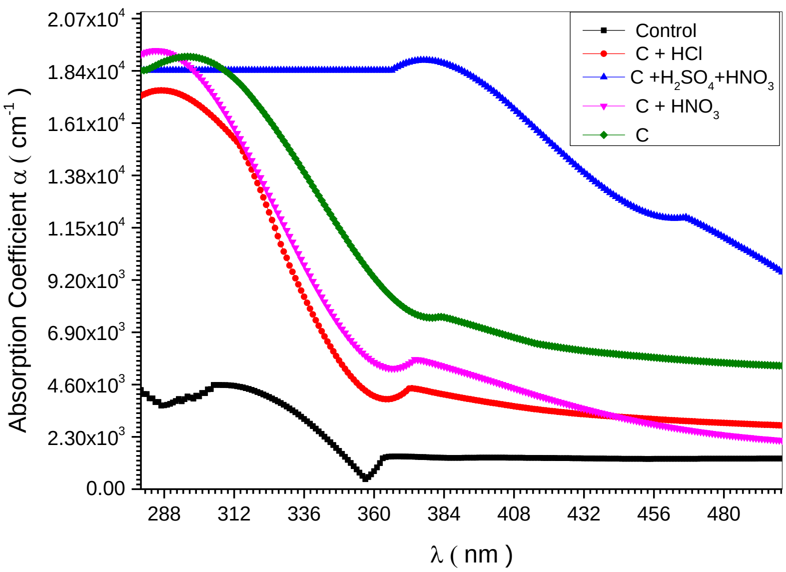

Fig (4)The optical absorption coefficient spectra of Waste Petroleum Coke Powder (WPCP) ,treatment three samples by acids (HCL,HNO_3 and H_2SO_4:HNO_3mixture) and one is un treatment and compeer by control Multi Wall Carbon Nanotubes sample (MWCNT

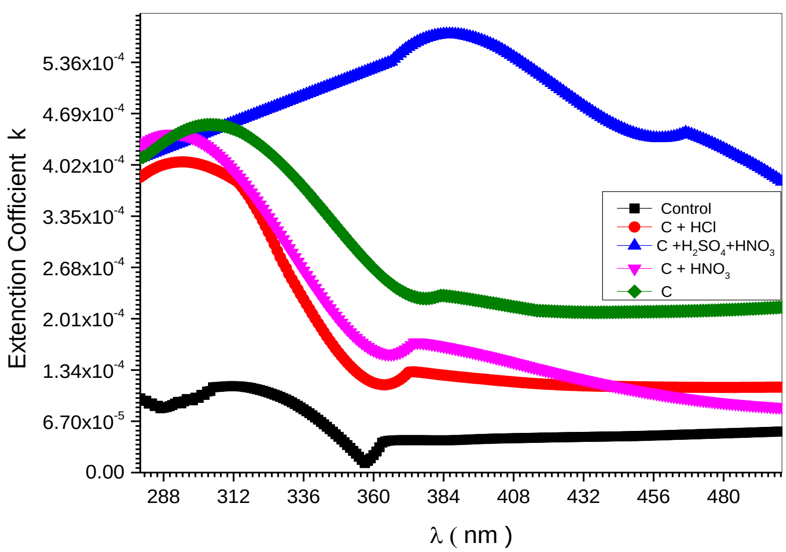

Fig (5)The Extinction coefficient (K) spectra of Waste Petroleum Coke Powder (WPCP) ,treatment three samples by acids (HCL,HNO_3 and H_2SO_4:HNO_3mixture) and one is un treatment and compeer by control Multi Wall Carbon Nanotubes sample (MWCNT)

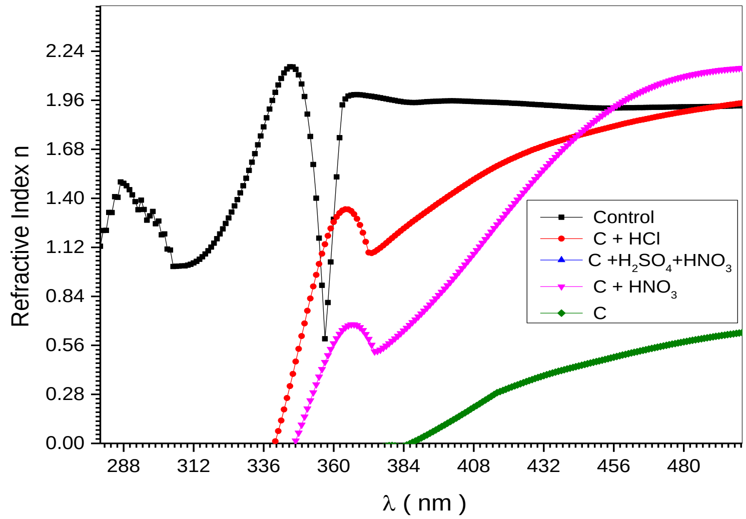

Fig (6)The refractive index (n) spectra of Waste Petroleum Coke Powder (WPCP) ,treatment three samples by acids (HCL,HNO_3 and H_2SO_4:HNO_3mixture) and one is un treatment and compeer by control Multi Wall Carbon Nanotubes sample (MWCNT)

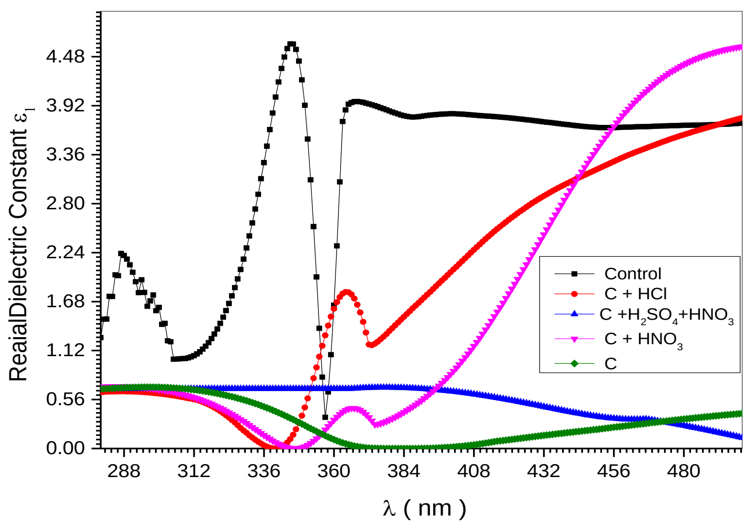

Fig (7)The real dielectric constant (ε_1) spectra of Waste Petroleum Coke Powder (WPCP) ,treatment three samples by acids (HCL,HNO_3 and H_2SO_4:HNO_3mixture)

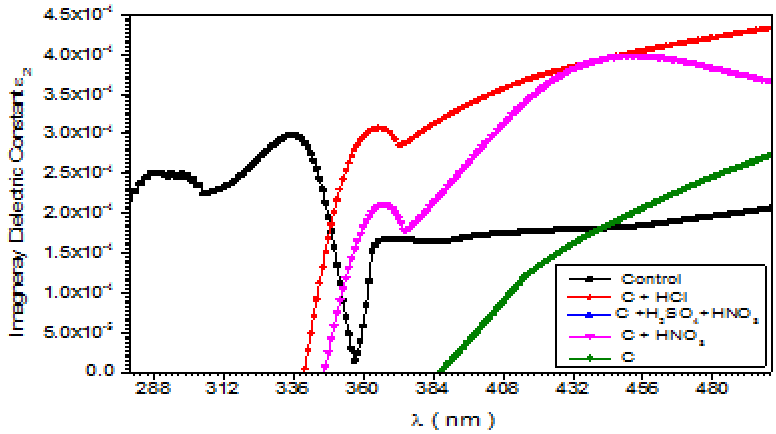

Fig (8)The real dielectric constant (ε_1) spectra of Waste Petroleum Coke Powder (WPCP) ,treatment three samples by acids (HCL,HNO_3 and H_2SO_4:HNO_3mixture) and one is un treatment and compeer by control Multi Wall Carbon Nanotube sample (MWCNT)

IV. DISCUSSION

- Absorption coefficient (α) and the extinction coefficient (k) are obtained by relations[9]
  $\alpha = 2.303\ A/t$

where (A) is absorbance and (t) is the optical axes length .
$K= \lambda\alpha/4\pi$

The absorption coefficient in fig (4) is maximum for (WPCP) treated by H_2SO_4:HNO_3 compared to control and non treated sample. The other two samples have less value than non treated one. The increase may be due to increase of grain size and decrease of number of defects by heat treatment[9,13].

- The value of refractive index (n) was obtained from the equation [9]

$$n = [(\frac{(1+R)}{(1-R)})^2 - (1+k^2)\,]^{\frac{1}{2}} + \frac{(1+R)}{(1-R)}$$

Where (R) is the reflectivity. The variation of (n) vs (λ) shown in Fig (6) shows that the refractive index is less than that of the control for all samples at all wave length values less than 485 nm except at about 350 nm , where the control has minimum value at this point. However, for wave lengths more than 485 nm (WPCP) treated by HNO_3 and (WPCP) treated by HCL have larger values compared to control.

-The dielectric real and imaginary parts are given by [11]

$$\varepsilon_1 = n^2 - k^2$$
$$\varepsilon_2 = 2nk$$

The real dielectric constant curves, shown in fig (7), indicates that the dielectric constant is smaller for all samples in the range (288-450 nm) compared to control .However for more than 180 nm (WPCP) treated by $HNO_3$and treated by HCL the values are larger than that of the control .This means that at large wavelengths, where the frequency nearly vanish and the current is nearly direct, the dielectric constant is relatively large. Thus the petrol nano carbon can be used to fabricate nano batteries.

V. CONCLUSION

The maximum conductivity of petrol samples shifts towards larger wave lengths compared to control. This means that one can maximize conductivity by using less energetic photons. The absorption coefficient is maximum when treated with H_2SO_4&HNO_3.The refractive index and the real dielectric constant, are however smaller for smaller eave lengths, while the ones treated with HNO_3&HCL have larger values for larger wave lengths.

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