PROJECT WORK

Submitted in partial fulfilment of requirement

Of the degree of

MASTER OF SCIENCE IN CHEMISTRY-2023

Submitted by

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Under the supervision of

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Dedicated to My Parents

-: ACKNOWLEDGEMENT :-

A moment comes which comes but rarely in a student's life, when with utmost pleasure and satisfaction, I myself, **SUBHAJIT TRIPATHY**, submit my project on **" Preparation of metal doped – rGO nanoparticle and its application ".** I take this opportunity to express my gratitude and sincere thanks to my project guide, **DR. KHOKAN SAMANTA** whose motivating personality, constant encouragement and sustained guidance has made this project to come true.

I am also thankful to our college principal **DR. P.K.TRIPATHI** & all my teachers **DR. D. PRAMANIK, DR. S. PATHAK, DR. S.K. MANNA, DR. B. JANA, Mr. U. S. MANNA, Mr. M. MONDAL** for their continuous inspiration. I also acknowledge all the staff members of our department.

I also acknowledge my parents, brother, my best friend and other family members for their moral support in my academic pursuits.

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CERTIFICATE OF APPROVAL

The foregoing project is hereby approved as a creditable study of a science subject carried out and presented in a manner satisfactory to warrant its acceptance as a prerequisite for the degree for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse of approve any statement mode, opinion expressed or conclusion drawn therein the thesis only for the purpose for which it is submitted.

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I hereby forward this Project entitled **" PREPARATION OF METAL DOPED – rGO NANOPARTICLE AND ITS APPLICATION "** by **SUBHAJIT TRIPATHY** in partial fulfillment of the requirements for the degree of **MASTER OF SCIENCE IN CHEMISTRY** of the Haldia Government College, Debhog, Haldia- 721657.

This Project has been completed under my guidance in the Department of Chemistry, Haldia Government College.

Countersigned

Supervisor

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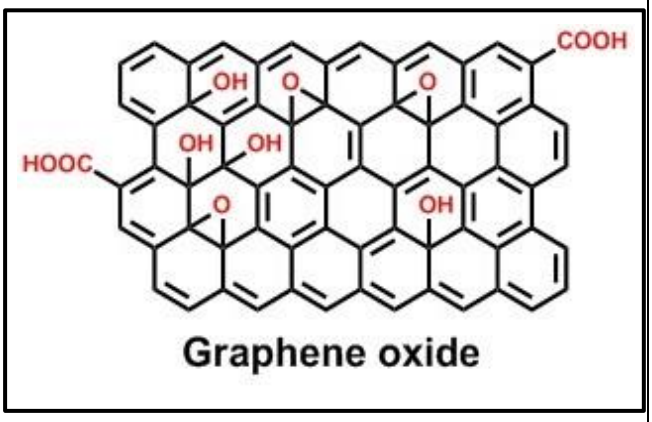
-: CONTENTS :-

PREPARATION OF METAL DOPED – rGO NANOPARTICLE AND ITS APPLICATION

1. INTRODUCTION :-

Graphite oxide is a compound of carbon, oxygen, and hydrogen in variable ratios, obtained by treating graphite with strong oxidising agent. The maximally oxidized bulk product is a yellow solid with C: O ratio between 2.1 and 2.9, that retains the layer structure of graphite but with a much larger and irregular spacing. The bulk material disperses in basic solutions to yield monomolecular sheets, known as graphene oxide by analogy to graphene, the single-layer form of graphite. Graphene oxide sheets have been used to prepare a strong paper-like materials, membranes, thin films, composite materials. The graphene obtained by reduction of graphene oxide.



Graphene oxide

Graphene and its derivatives, as one of the hottest research topics in recent years, have been applied in various fields such as nanoelectronics, energy storage, material science, and biotechnology due to their unique physical and chemical properties. Recently, various RGO/metal nanoparticle (MNP) hybrids have been synthesized and developed rapidly. The RGO/MNP hybrid nanomaterials have unique optical, chemical, electrical, and catalytic properties and present excellent performance when they are utilized for distinctive bioapplications. rGO have an extermly high surface area; therefore, these materials are considered for usage as electrode materials in batteries and double layer capacitor. By the Hummer's method obtained reduced graphene oxide. The obtained rGO further reaction with

Ticl4 and get Ti-np-rGO . this metal doped rGO can be used to produce bio-hydrogen gas and can be produced di,tri,and tetra arylethylene followed by Mcmurry reaction .

Metal doped rGO has ability to store hydrogen may, in future,prove very useful for the storage of hydrogen fuel in hybrid cars. Nanocomposite of GO/rGO can also be used for higher capacity energy storagein lithium batteries.

The metal rGO provides benefits like enhanced peroxide like catalytic activity , high surface, electrical con ductivity,thermal stability& optical property .These properties make it a better platform for sensing environmental pollutants,and metabolites inducing biologically important analytes with high specificity and selectivity.

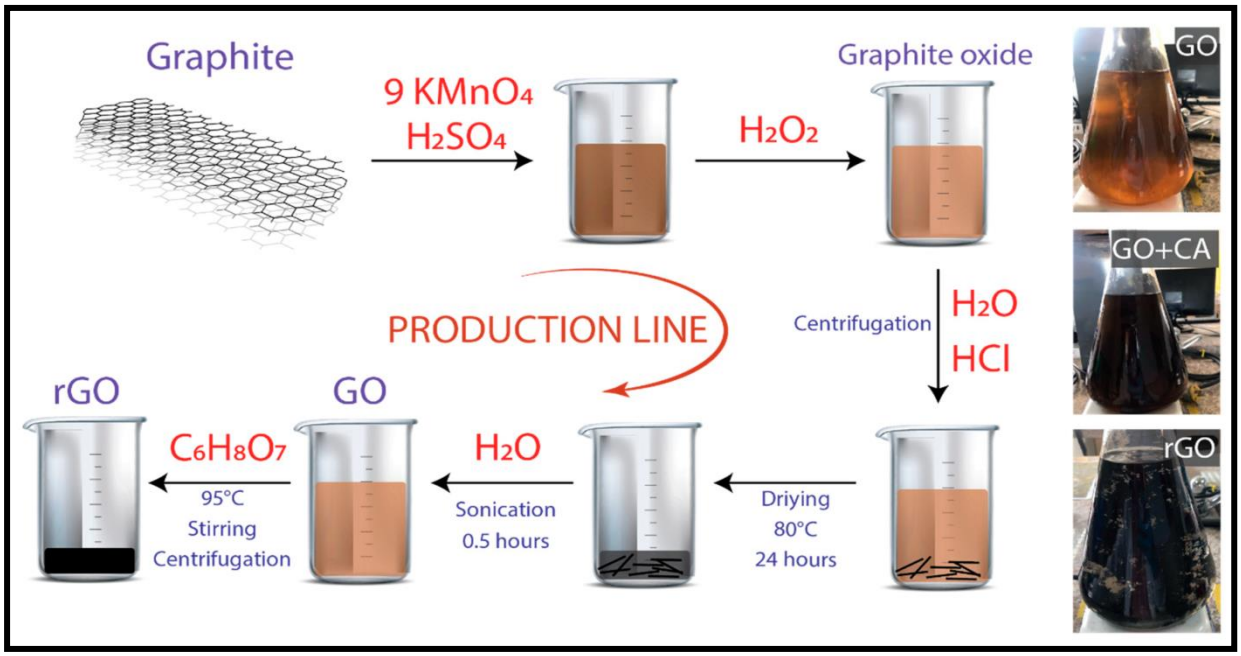
2. PLANE OF THE WORK :-

A. PRESENT WORK :-

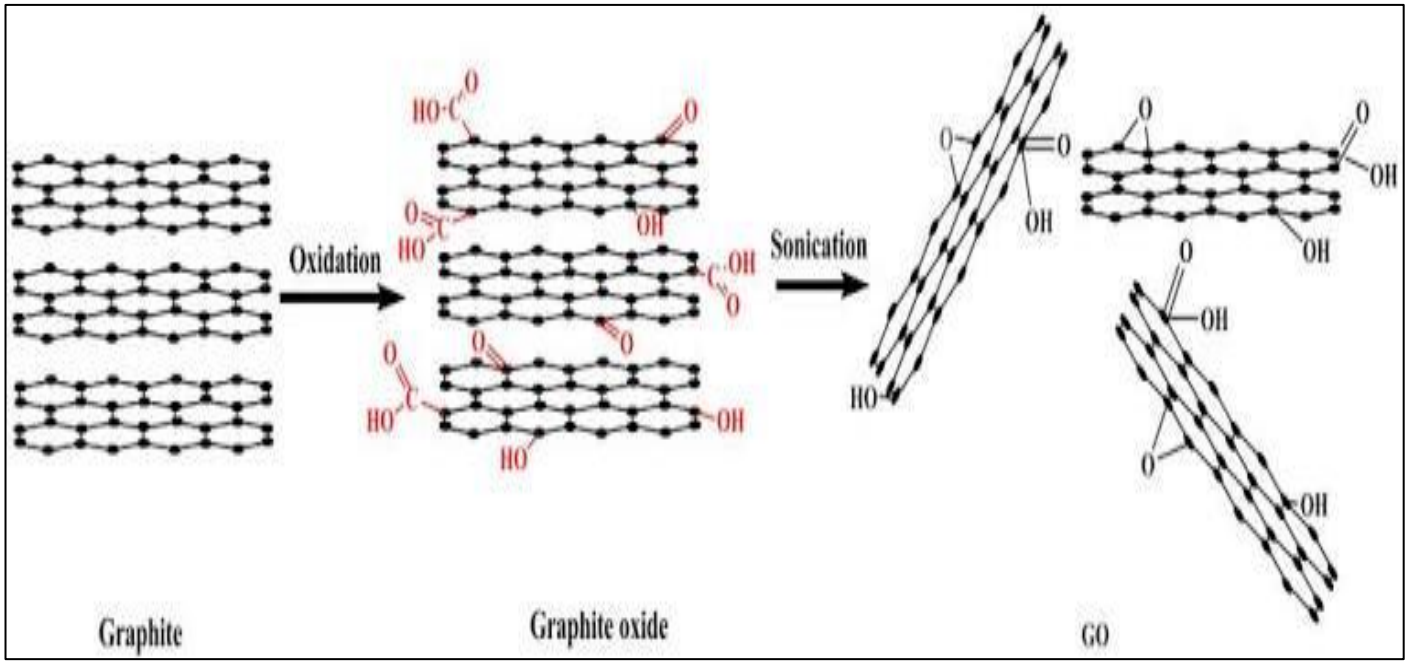
- In this project we are trying to explain that the preparation of metal doped – rGO nanoparticle and its application.
- In this regard we were prepared graphene oxide then produced Ti metal doped –rGO nanoparticle, which will help the scientists for satisfactory chemical manufacture. It will provide more sustainable alternative pathway as catalyst can be easily complete organic synthesis.

- **PREPARATION OF GRAPHENE OXIDE (GO) :-**

Graphene Oxide(GO) was prepared from graphite powder, by using Hummer's method. At first, 2gm of graphite powder and 0.5gm sodium nitrate were mixed together followed by the addition of 50ml conc. Sulphuric acid under stirring condition. After 1hour ,3gm $KMnO_4$ was added gradually to above the solution while keeping the temperature less than 20^{o}c to prevent overheating and explosion. The mixture was stirred at 35^{o}c for 2h and resulting solution was diluted by adding 50ml of water under vigorous stirring. To ensure the completion of reaction with $KMnO_4$, the suspension was further treated with 30% hydrogen peroxide solution (5ml). The resulting mixture was washed with HCl and water respectively, followed filtration and drying, graphene oxide was thus prepared.

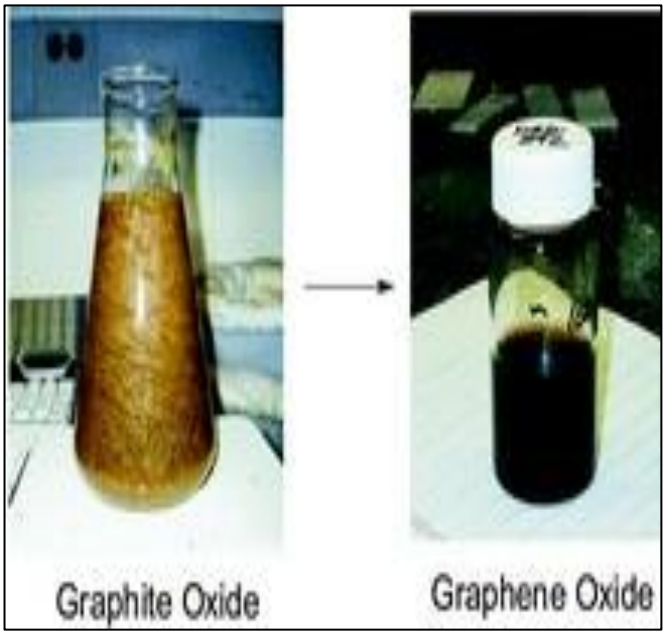


THE FORMATION OF GRAPHENE OXIDE FROM GRAPHEDE



The structural configuration of Graphene oxide.

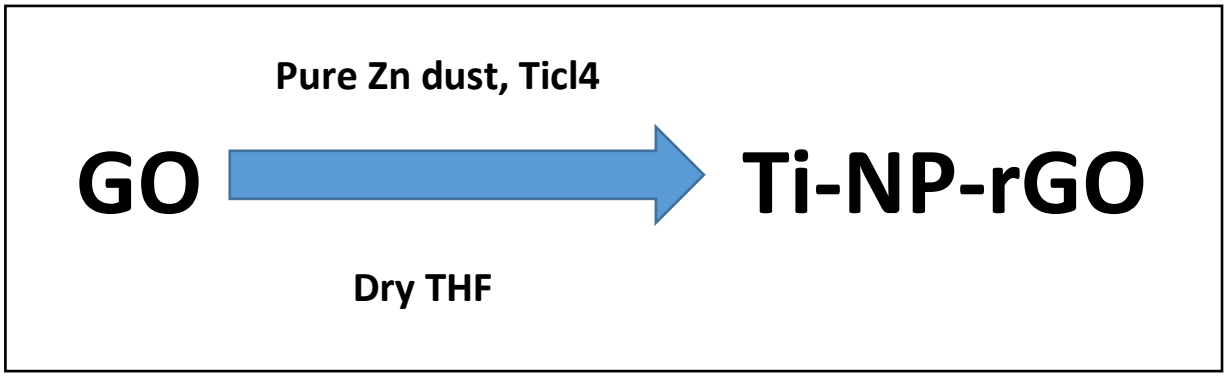
❖ G.O. prepared in our laboratory :-



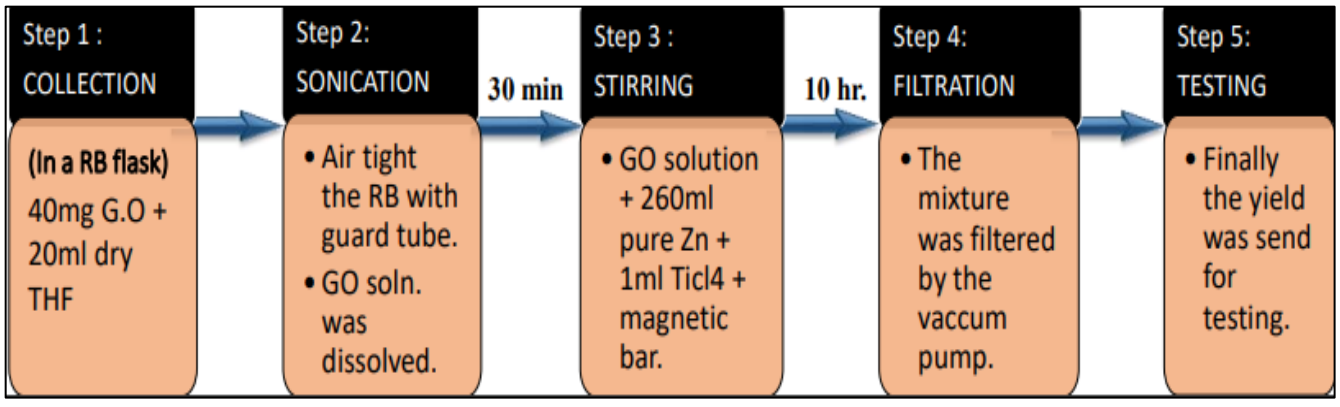
- **PREPARATION OF METAL (Ti) DOPED – RGO :-**

In the typical experiment, 40 mg graphene oxide was added to a 20 ml of dry THF solution in a 100 ml round bottom flask. Then the flask was airtight by a guard tube. Then the GO solution was dissolved by the help of sonicator machine with in 30 minutes. After the process, 260 mg of pure Zn was added and shaked well , then 1 ml of Ticl4 solution was added to mixture carefully and started magnetic stirring for 10 hours. After that, the mixture was transferred to a suction flask followed by a vacuum pump . After that, the dried mixture was collected to the filter paper.

❖ CHEMICAL REACTION :-



➢ PROCEDURE :-



- **EXPERIMENT :-**

SOME IMPORTANT SPECTROSCOPIC DATA OF G.O. :-

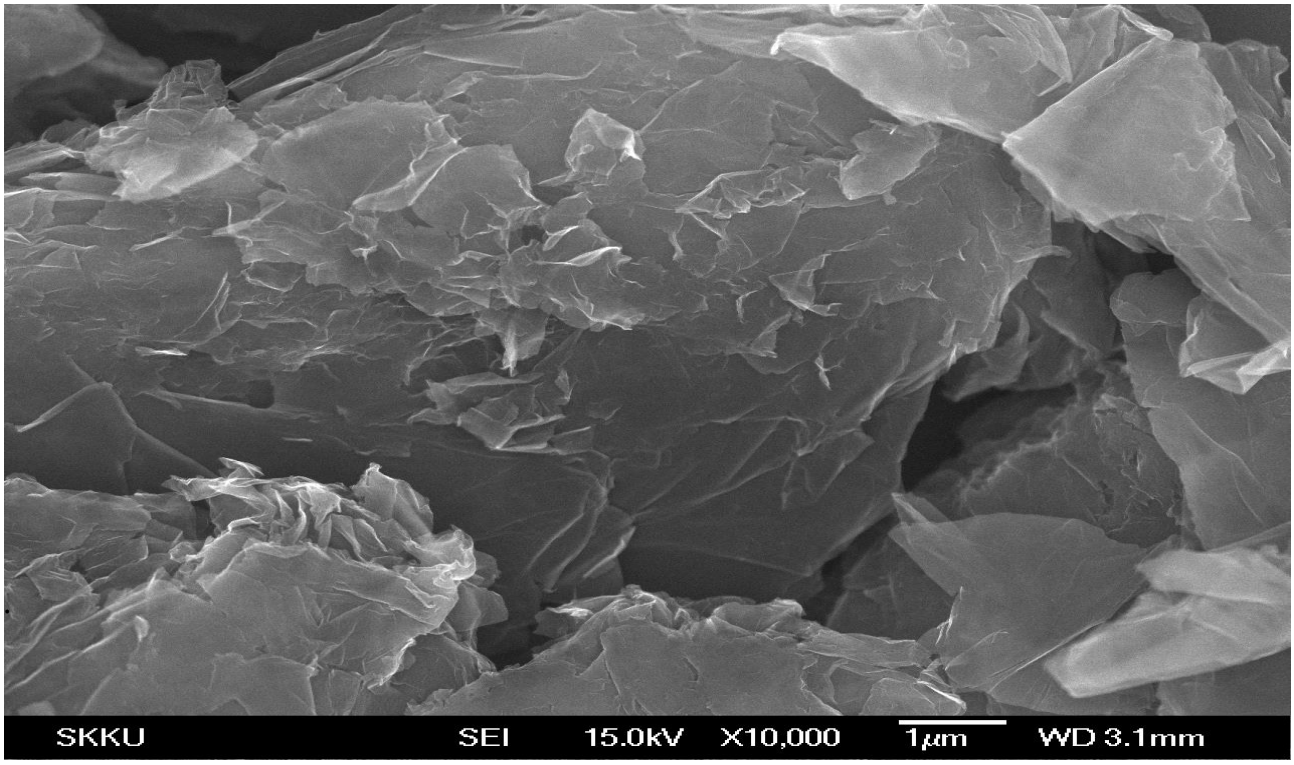


Fig.-1: SEM OF G.O.

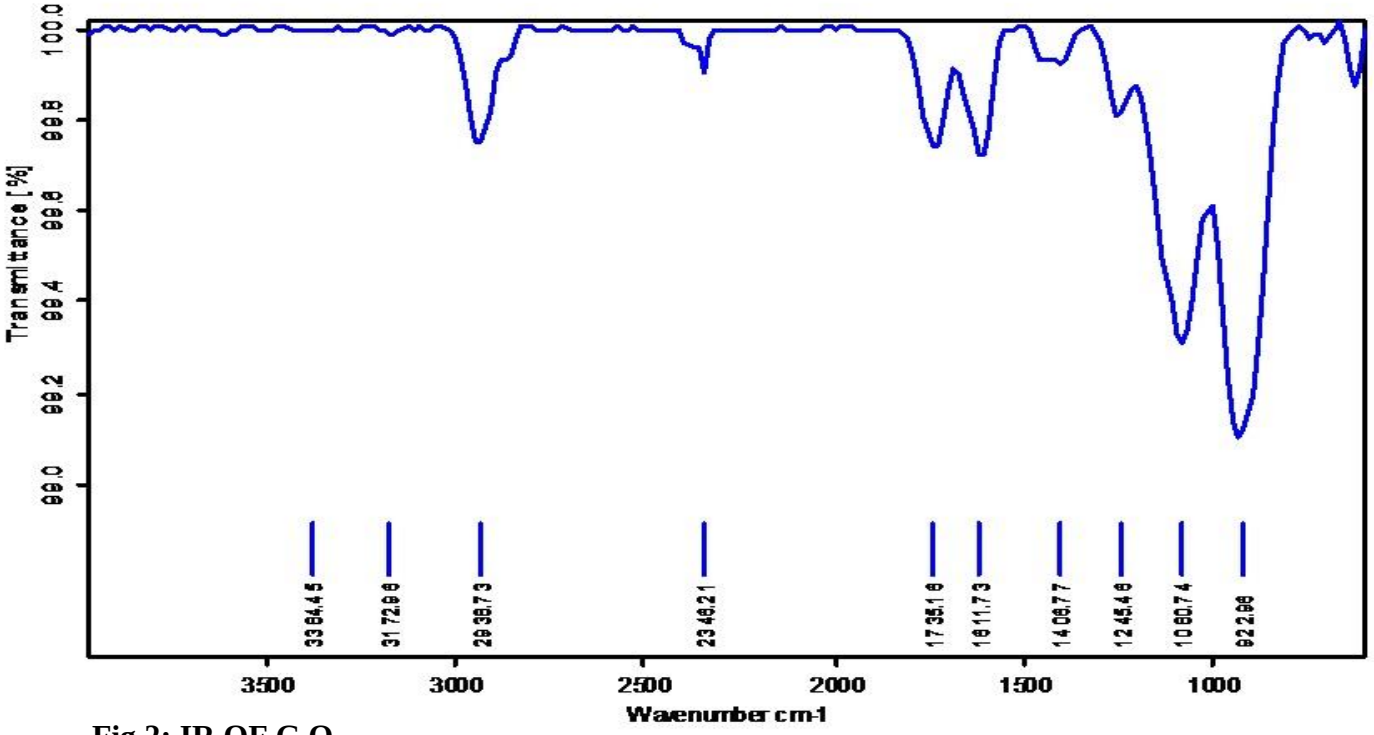


Fig.2: IR OF G.O.

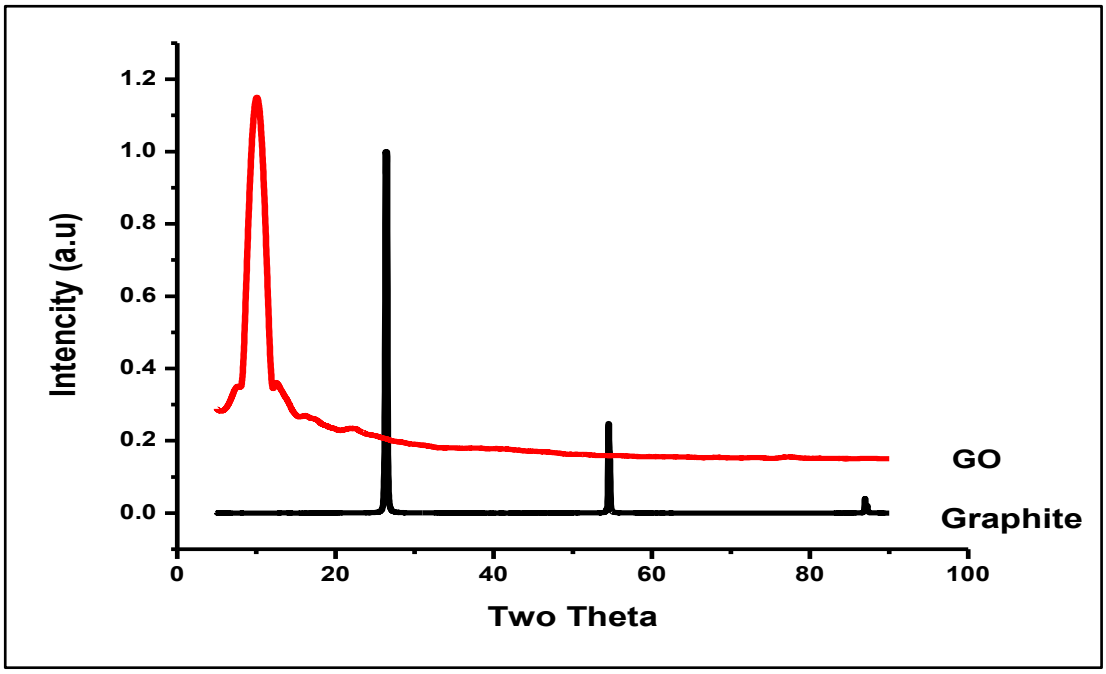
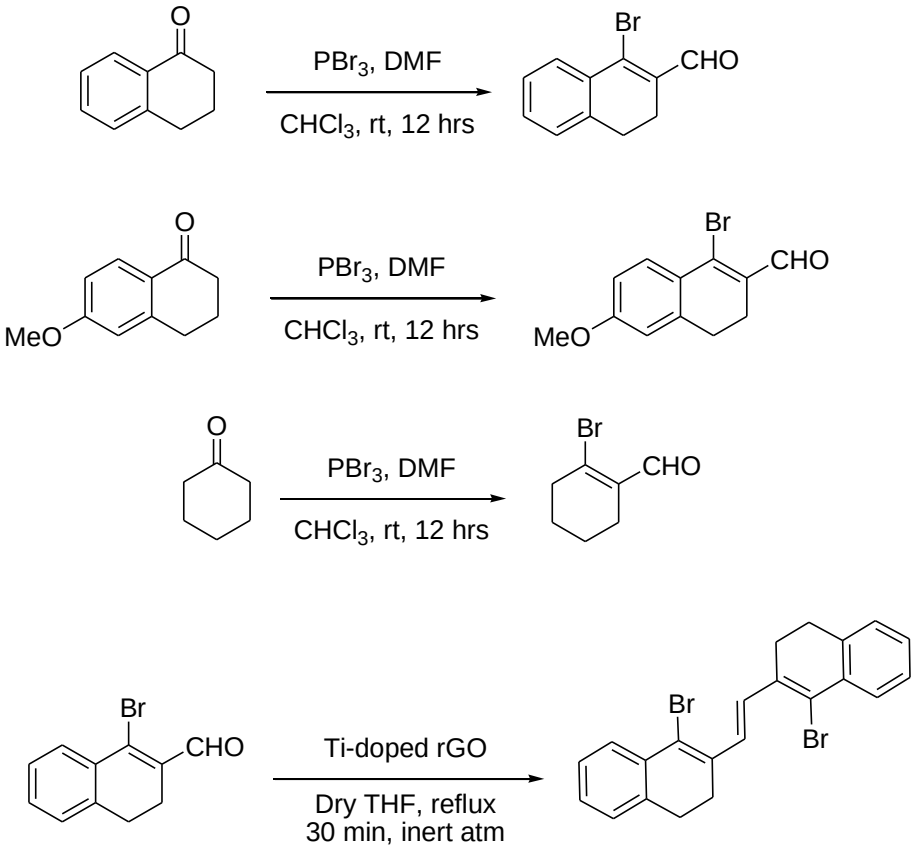


Fig.-5: XRD OF G.O. & GRAPHITE

B. APPLICATION OF THE NANOMATERIALS :-

Ti-doped rGo is used for the McMurry reaction of bromoaldehyde prepared in our laboratory. Characterization of the product is under process.



Scheme:- Synthesis of Bromoaldehyde and McMurry Reaction.

3. CONCLUSION :-

The Ti doped – rGO nanoparticle will provide more sustainable alternative pathway as catalyst can be easily separated from the reaction mixture on most routes and can be recycled and reused without apparent loss of activity making it economic.

Considering the practical ability of graphene-based catalyst in various fields of science and technology and the sustainability of their use compared to metal-based catalysed in organic synthesis, it is easy to predict that the area will grow extensively in the years to come; and further research is needed to identify an optimized catalysis in various organic transformations and to develop an environmentally friendly , energy-efficient and cost-effective method for graphene-based nanocomposites synthesis.

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