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MATERIALS SCIENCE — ADVANCED MATERIALS IN NANOTECHNOLOGY FOR SUSTAINABILITY

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ABSTRACT

Growth of the single crystalline and polycrystalline materials are directly proportional to the MICROWAVE PLASMA in the range of 1 kv to 4 kv, Methane gas (CH_4) in the range of 5 to 60 SCCM, Oxygen gas (O_2) in the range of 2 to 10 SCCM. Hydrogen gas 100 - 600 SCCM and Argon gas in the range of 0.05 to 0.5 SCCM with water cooled HPHT- Vacuum Chamber in the range of 10ºC to 24ºC. Plenum pressure in the range of 0.1 - 135 torr and chamber pressure 10 -150 torr. All the components of the vacuum system are connected from automatic Smart PC which is mounted on Rack monitor and is used to to control different parts like MFC, power supply, microwave, rotary vane pump and valve for rough vacuum or base vacuum and valve for high vacuum. All the parameters are set in the PC Interface and used to press the start button all parameters are active and start to glow plasma in chamber after injecting gases in the vacuum chamber one by one as per need of Growth of the single crystalline and the Growth of the poly crystalline use seki device in the year of 2016.

KEYWORDS: Microwave plasma, seki device, HPHT, CVD Nano carbon (single crystalline and polycrystalline) etc.

INTRODUCTION

Plasma physics is used for various field for development of nanomaterials by using Nanotechnology in one them is CVD process .Here CVD technique is used to Growth of the single and polycrystalline nano carbon at HTHP under vacuum chamber with molybdenum substrate holder with plenum pressure by using injecting Hydrogen gas(H2),Methane gas (CH4) ,Oxygen gas (O2) and it is used for coating of nano carbon for high heat resistive non conductive materials.

MATERIALS AND METHODS

Method of C.V.D Process: The growth of the single crystalline and polycrystalline is obtained by using plasma method under water cooled high vacuum microwave plasma in the presence of Methane(CH_4), Hydrogen(H_2), Oxygen(O_2) gas. A chemical reaction is occurred in the region of plasma ball inside the vacuum chamber just above the single crystalline seed on the molybdenum holder which diameter 50mm × thickness 5mm is hold by plenum pressure. The plasma ball is created inside vacuum chamber due to presence of three mixtures of gases *i.e.* Hydrogen, Methane, Oxygen and microwave. The seki CVD system is fully water cooled vacuum chamber because the growth of the single crystalline and polycrystalline materials is at higher temperature approx 1400ºC .A quarts glass is used around the molybdenum holder for preventing the heat region which dimension is id - 150mm × thick - 5mm × height - 100mm cylindrical shape .

RESULTS AND DISCUSSION

ExperimentaL : The growth of the nanocarbon is starting on the single carbon seed dimension 4mm × 4mm × 0.5 mm which is kept on the the molybdenum holder when Microwave is active in the presence of three gases hydrogen, methane and oxygen at particular range of setting parameters inside the HPHT Vacuum Chamber. All the parameters of the systems are controlled or set by Smart INTERFACE MONITOR WHICH IS BUILT IN RACK .The following steps are given for the Experimental method.

First of all set the required parameters in the given Interface and press the start button then all the setting parameter will be active and system will start to work.

Step1: Start the cooling line to cool the chamber at a temperature range between 18ºC -21ºC

Step 2: Keep microwave in standby and inject Hydrogen gas by MFC 1 at a particular parameter for etching carbon seed.

Step 3: Setting Time , chamber pressure , plenum pressure,microwave ,Hydrogen gas .

Step 4: Set time for Chamber pressure, plenum pressure ,microwave, and gases (Hydrogen,Methane and Oxygen).

It has been shown in the following picture.

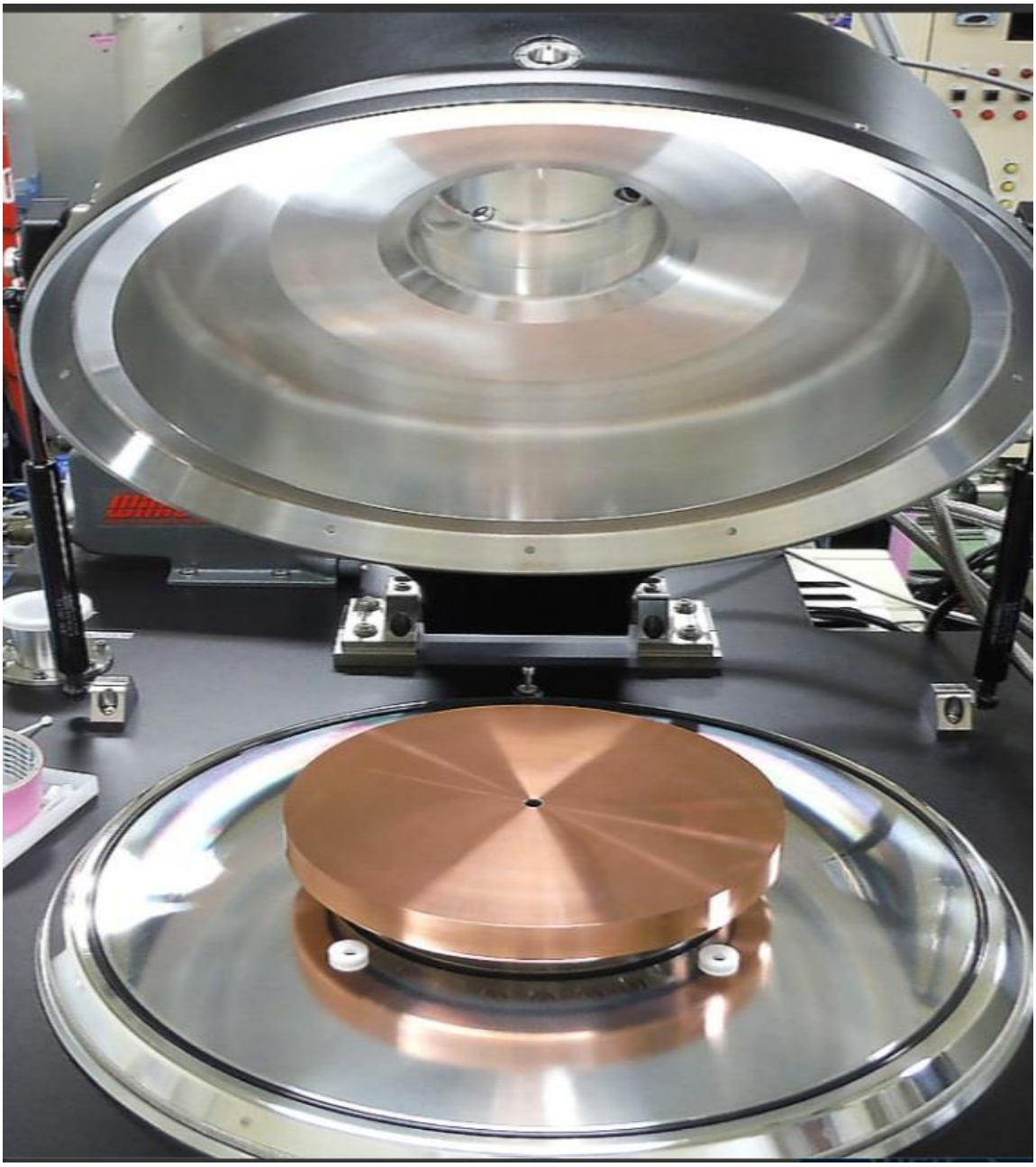
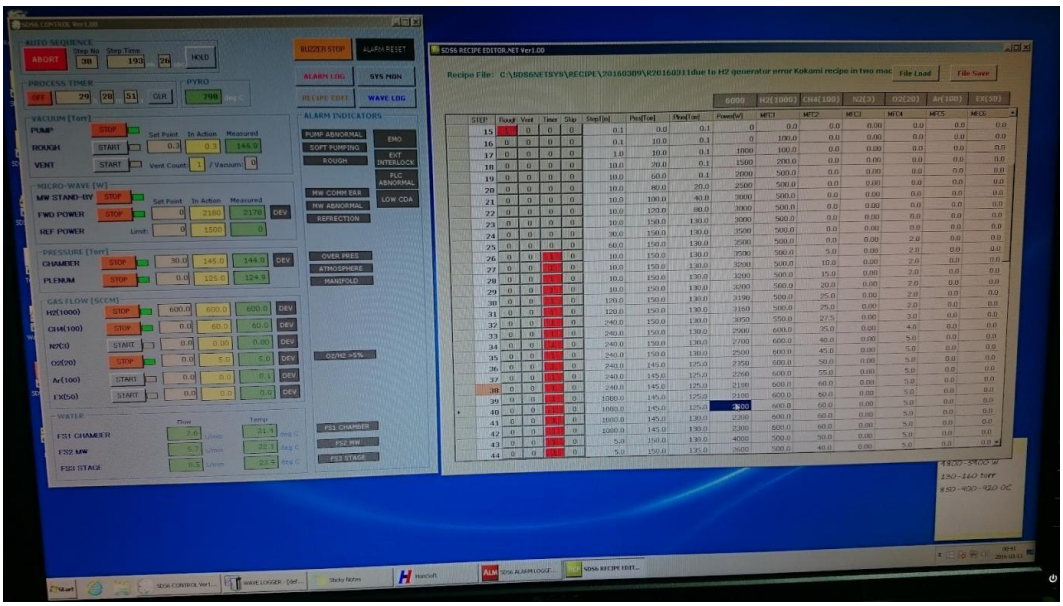


Fig-1.CVD copper conductor on quartz glass.

Vacuum Chamber copper conductor with orifice for plenum pressure

Experimental parametrs

1) Temperature range of water colling of the microwave and vacuum chamber.
2) Plenum pressure
3) Chamber pressure
4) MFC :Mass flow Controller for injecting gases inside the vacuum chamber
5) Power of MICROWAVE in kwatt
6) Rotary pump for vacuum mode



Desktop Interface auto controller parametrs

Fig2. a). Single crystalline growth inside view under plasma ball analyse from outside upper quartz glass window .

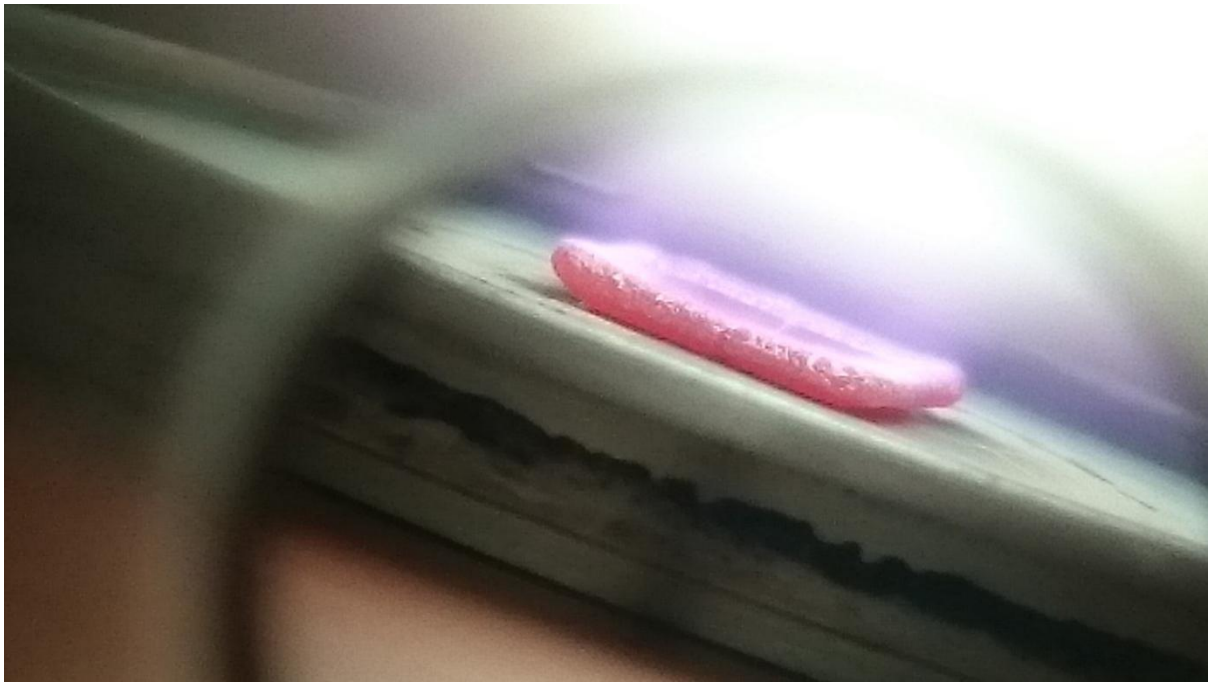
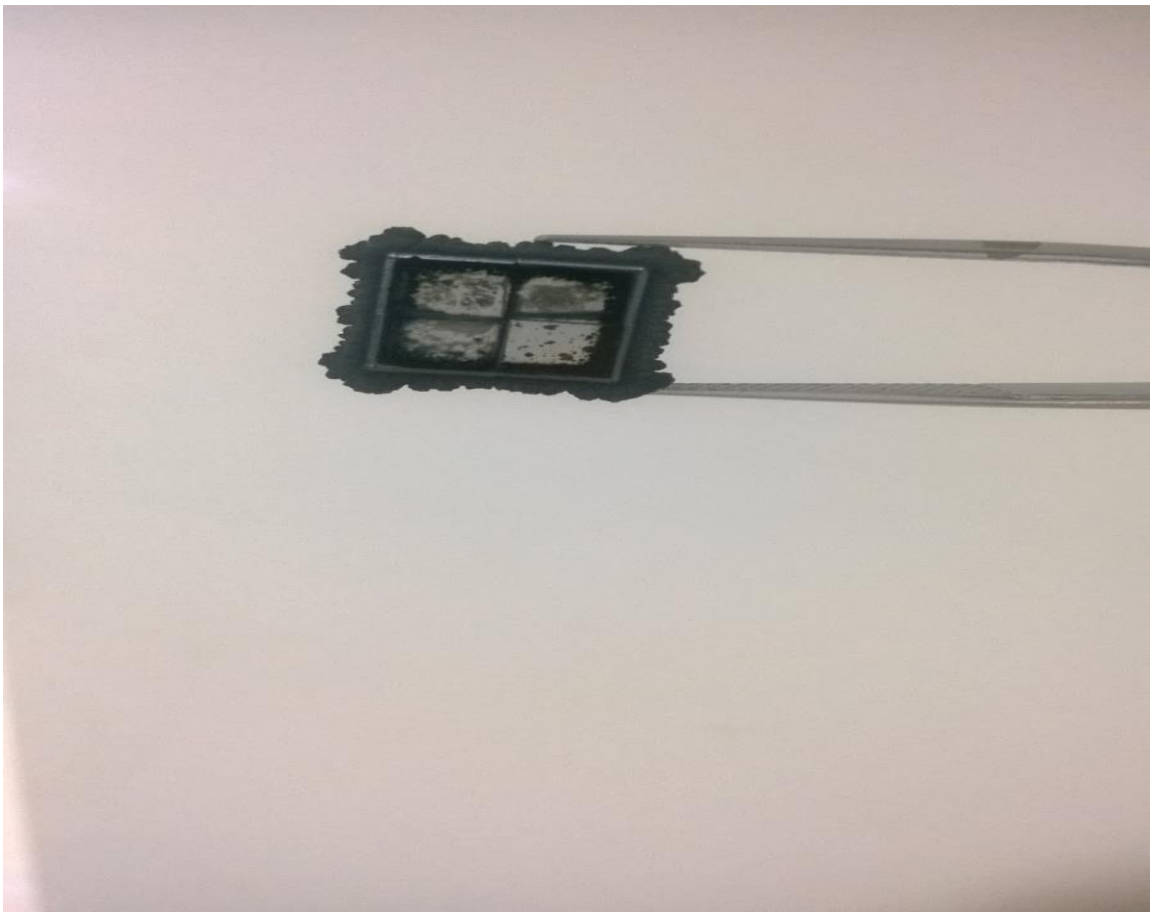


Fig.3). A quartz glass window is used for analysing the growth of nano carbon and plasma ball position.



4 PCs Single crystalline is shown in the above pic.

Application

CVD plasma method tremendous use as Industrial field, Scientific field, medical field, Research and Ornaments.

CONCLUSION

1. Plasma PHYSICS tremendous use for growth of the nano crsytalline and non crystalline advanced materials as coating on other materials.
2. Single crystline carbon is coating on other materials for good higher thermal conductivity
3. Single form of the carbon is using in space ship as window for safety purpose
4. It is non conductive materials which avoid electrical signals for detection
5. This substance is obtained by Seki CVD system.

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