Project Title: "Incorporation of DLN in a solar cell structure as a replacement of silicon nitride,"

Principal Investigator: Dr. Debasish De

Department of BSH, MSIT

Objectives of the project: The major objective of the approved project is to find out an alternative material for solar cell application instead of conventional Silicon Nitride material which involves less hazardous pathway and even better performance. In this project we had developed the Diamond Like Nanocomposite (DLN) as a unique material for solar cell application by alternate deposition technique to check its reproducibility and industrial feasibility which is yet to be explored. In this investigation we are using simple, less hazardous organic precursor instead of ammonia and silane for conventional silicon nitride preparation. We had developed MWPECVD instrument in our country with utilizing the expertize of Omicron Scientific Ltd New Delhi and successfully installed at our institute Meghnad Saha Institute of Technology (MSIT) in collaboration with IIEST, Shibpur. There is additional scope to add extra facility with the progress of research and development that is another advantage of in-house fabricated instrument. Though we had purchased the best quality accessories from abroad but in house fabrication process of MWPECVD shows us there is 30% - 40% cost reduction for our fabricated instrument in comparison to the imported one. In near future if we are able to develop the accessories in our country it will be one step ahead for making independent INDIA.

Fig.1: Fabricated **linear antenna based MWPECVD** unit (Made in India) of 2.45 GHz frequency and installed at Meghnad Saha Institute of Technology .

Few interesting findings of MWPECVD processed DLN films are given below.

- Appearance wise MWPECVD assisted DLN coating over c-Si is as good as conventional silicon nitride.
- Uniform plasma intensity throughout the microwave chamber will satisfy our expectation for large area uniform coating which is very much essential for solar cell fabrication application with high throughput value.
- Light absorbing characteristics of DLN coated c-Si sample shows good refection minima with broad band characteristic.

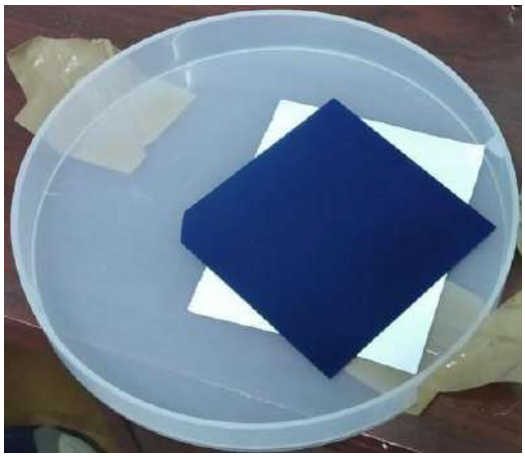

Fig2- Appearance of DLN coating by MWPECVD Fig3.- Uniform plasma glow as seen from chamber window.

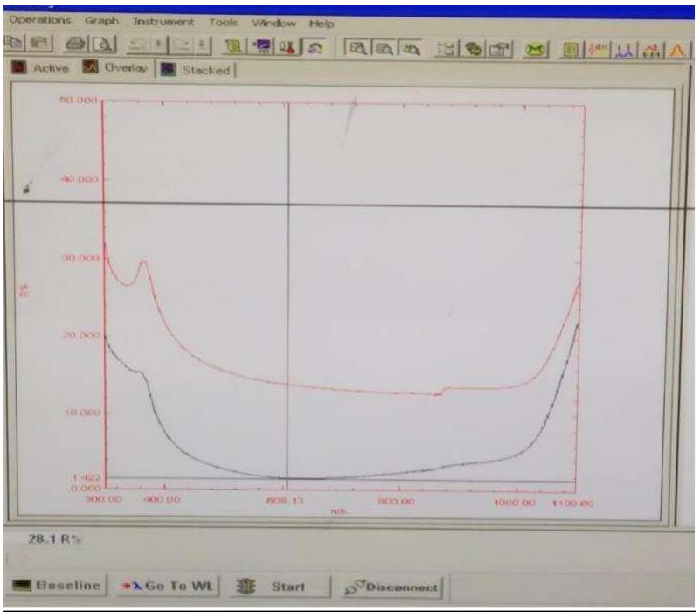

Fig 4. Reflection characteristics of DLN coated Si (Black line) and Ref. Si (Red line)

Versatility of our instrument: Finally, at collaborators lab at IIEST work is going on to develop electrodynamic screen (EDS) for dust repulsion on solar PV modules for which a dielectric coating on the EDS will be required. Successful development of large area Dielectric film already experimented at MSIT is of great interest to the EDS development and the system needs to be maintained in good condition for the same.

This system can also be used for making plasma polymerized thin film at low frequency which has also application for biosensor.

It is a step ahead for making "Atmanirbhar Bharat" in manufacturing of Solar Cell with low cost technology using MW-PECVD method.

File No. DST/TM/CERI/D05(C)
Government of India
Ministry of Science & Technology
Department of Science & Technology

Technology Bhavan
New Mehrauli Road
New Delhi-110 016
Date: 01/09/2016

Sanction order

Subject: Financial support for project entitled **"Incorporation of DLN in a Solar Cell Structure as a replacement of Silicon Nitride"** by Dr. Debashish De, Assistant Professor, Meghnad Saha Institute of Technology, Nazirabad, Uchhepota via Sonarpur, Kolkata-700150 West Bengal and Prof. Partha Chaudhuri, Centre for Excellence for Green Energy and Sensor System, Indian Institute of Engineering Science and Technology Shibpur, Howrah, West Bengal-711103.

With reference to the sanction Order No. **DST/TM/SERI/D05(G)** dated 01/09/2016 Sanction of the President is hereby accorded to the payment of **Rs. 92,81,250/- (Rupees Ninety two lakh eighty one thousand two hundred fifty only)** as the Grant for creation of capital assets in the above-mentioned project.

2. The amount **Rs. 92,81,250/- (Rupees Ninety two lakh eighty one thousand two hundred fifty only)** will be disbursed to Meghnad Saha Institute of Technology account DST 1 through Bank Account No. 910010034537182 IFSC Code: UTIB0000319, Axis bank Ltd. Electronic Complex Plot; XI-16, Block-EP & GP, Sector-V Salt Lake City, Kolkata-700091, West Bengal.

3. The expenditure involved is debitable to -

Demand No.77 Department of Science & Technology
3425 Other Scientific Research (Major Head)
60 Others (Sub-major Head)
60.200 Assistance to other Scientific Bodies (Minor Head)
26 Technology Development Programme
26.01.35.9 Grants for creation of capital assets - Plan (CERI)

4. The sanction has been issued under the powers delegated to the Ministries and with the concurrence of Integrated Finance Division of Department of Science & Technology vide P no. 3682 and Concurrence dairy no. C/2907/IFD/2016-17 dated 01/09/2016.

5. This is the first release in the project under capital head. The Institute will furnish to the DST, utilization certificate and audited statement of accounts pertaining to the grant immediately after the end of each financial year.

6. All purchases of equipments etc. would be as per GFR and the disposal of the same would be done with prior approval of DST.

7. The organization/Institute/University should ensure that the technical support/financial assistance provided to them by the Department of Science and Technology should invariably be highlighted/acknowledged in their media releases as well as in bold letters in the opening paragraph of their Annual Report.

8. The Institute/Agency will maintain separate audited accounts for the project and would keep the whole of the grant in a bank account earning interest, the interest earned should be

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reported to the DST. The interest thus earned will be treated as a credit to the institute/Agency to be adjusted towards further installment of the grant.

9. In case the amount sanctioned for disbursement under this sanction is not received by the with in 14 days of the date of this sanction, Principal Investigator may bring the same, with IFD diary no. and date of sanction etc, to the notice of COA, for looking into the matter.

10. As per Rule 211 GFRs, the accounts of the project shall be open to inspection by the sanctioning authority / audit whenever the Institute is called upon to do so.

11. There is no due pending UC from the organisation for this scheme/project and efforts are being made by the PD/Grantees to upload the UC's on PFMS.

12. Sanction has been entered at Sl no **79** in the register of grants (2016-2017) CERI maintained by the division.

(Vineet Saini)
Scientist 'D'

To,

The Pay and Accounts Officer
Department of Science and Technology
New Delhi-110 016

Copy for information and necessary action to:

1. Cash Section (3 copies) for preparing the bill and remitting the amount to the above grantee.
2. Accounts Section, DST, New Delhi.
3. IFD, DST, New Delhi.
4. The Director of Audit, III Floor, AGCR Building, IP Estate, New Delhi
5. Dr. Debashish De,
   Assistant Professor,
   Meghnad Saha Institute of Technology,
   Nazirabad, Uchhepota via Sonarpur,
   Kolkata-700150 West Bengal
6. The Principal,
   Meghnad Saha Institute of Technology,
   Nazirabad, Uchhepota via Sonarpur,
   Kolkata-700150 West Bengal
7. Prof. Partha Chaudhuri
   Centre for Excellence for Green Energy and Sensor System,
   Indian Institute of Engineering Science and
   Technology Shibpur, Howrah, West Bengal-711103
8. The Dean-R&D,
   Indian Institute of Engineering Science and
   Technology Shibpur, Howrah, West Bengal-711103
9. Sanction folder
10. Master File
11. Office Copy
12. Dr. Sanjay Bajpai, Scientist 'G', Member Secretary (CERI)
13. FICCI Cell

(Vineet Saini)
Scientist 'D'

Setting Up new lab for Solar cell ARC by MWPECVD

Picture of MWPECVD instrument for thin layer deposition

Picture of MWPECVD instrument for thin layer deposition