



Project Proposal for Ph.D.

Project Details (The research problem must clearly indicate the need for an interdisciplinary approach)

Project Title	Plasma assisted deposition and study of functional metamaterial absorber film for energy applications
Project Summary (Minimum 500 and maximum 2000 characters)	Solar cells have been recognized as devices providing pollution-free renewable energy. In particular, thin film solar cells offer various advantages, such as tunable properties, moderate production cost, and high flexibility. Emerging research in this field has largely been based on the enhancement of the efficiency of such devices. Many works are being undertaken to solve this issue in different ways, e.g., using multi-junction and tandem structures, the light trapping method, the development of new materials, photonic crystals, and an anti-reflection layer. Consequently, one needs to attain higher conversion efficiency and increase the short-circuit current density, typically in the visible region. Metamaterials (MM) have recently garnered significant attention in solar energy generation. These engineered materials could offer a pathway to high-efficiency solar cells by exerting precise control over the light absorption and conversion into electricity. Thus, using metamaterials, it could be possible to manipulate the absorption and scattering of light, which could have an advantageous effect on the efficiency of traditional solar cells. Thus, this proposal aims to develop and study plasma-based deposition of functional metamaterials as the absorber layers for their potential applications in energy-generating devices. Plasma and radicals will be controlled to tune the properties of the deposited films at various operating conditions. Based on the expertise in developing different kinds of plasma systems for different applications, PI (Dr. Sahu) would be able to develop a radical controlled plasma process for the deposition of the meta structures. The functional properties of the deposited films will be critically analyzed using the expertise of Co-PI (Dr. Kumar). Thus, the proposed project will be undertaken by a full-time JRF student (if found suitable in the interview) using the combined expertise of both PI and Co-PI.

Ph.D. Supervisors ⁺ (Supervisor 1 and Supervisor 2 cannot be from the same department of IITD)			
Role	Name of Faculty	Academic Unit in IITD/Institute/University	Email ID (Official) & Contact Number
Supervisor 1*	Bibhuti Bhusan Sahu	Department of Energy Science and Engineering, IITD	bbsahu@dese.iitd.ac.in
Supervisor 2	Sunil Kumar	Department of Physics, IITD	kumarsunil@physics.iitd.ac.in

*Supervisor 1 must be from IIT, Delhi.

+All cells in this table are mandatory fields that need to be filled by faculty for consideration of proposal.

\$The date of superannuation of supervisors should be at least three years from the date of registration of selected candidates.

Project requirements (Student qualifications, experience required, etc)

*The candidate will be shortlisted based on common shortlisting criteria decided by ScRC (SIRe)

- Qualifications: Master in Physics/Material Science, M.tech. in relevant discipline, etc.
- Experience: Student should have the experience in Material science/Solid State Physics, etc.

Source of fellowship/funding and project number
(CSIR/UGC/DBT/ICMR/ICAR/NEET-PG/DST-INSPIRE/IRD/FITT Project details, if any)

Students having CSIR/UGC fellowship only.

Role of Faculty Members involved:	
Supervisor-1	Design and development of plasma process and supervise for Plasma processing of material
Supervisor-2	Material characterization and supervision of material analysis.

Note :-

1. Approval from the respective DRC/CRC/ScRC of your Department/Centre/School will be required for using the "Full-time Institute Assistantship (Category-wise) (FIA)" for selecting the students in SIRe.
2. Declaration:- Faculty members, please ensure that you have at least 3 years of service left before superannuation along with adequate sitting space & lab facilities for the SIRe student.
3. PI/s are also encouraged to submit joint proposals with AIIMS, NII, JNU and institutes with which IITD has an existing MoU. If the Co-PI (Supervisor 2) is from outside IITD, kindly share his/her detailed CV.
4. If a research scholar is to be considered for selection under the project fellowship, then the project should have a minimum of two-year duration remaining.
5. A candidate applying with a valid JRF/INSPIRE/any national level fellowship should have at least two-year validity from the date of joining the Ph.D. program.
6. The third supervisor’s name (if required) can be added only after the formation of Student Research Committee (SRC) subject to a strong recommendation of SRC and subsequent approval from the competent authority.
7. If Institute fellowship is being sought, then DRC approval of the parent department of Supervisor 1 is required at the time of selection.