Indian Institute of Technology Delhi

School of Interdisciplinary Research (SIRe)

Project Proposal for Ph.D.

SIRe Project Number

2025-01-27

(will be assigned by SIRe)

Project Details	
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

Role	Name of Faculty	Academic Unit in IITD/Institute/University	Email ID (Official)
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

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
(CSIR/UGC/DBT/ICMR/ICAR/NEET-PG/DST-INSPIRE/IRD/FITT Project details, if any)

Candidate with his/her own fellowship /institute assistantship

Role of Faculty Members involved:

Supervisor-1	Plasma and based deposition process, optimization
Supervisor-2	Material development and analysis, Photonics/Spectroscopy