Indian Institute of Technology Delhi

School of Interdisciplinary Research (SIRe)

Project Proposal for Ph.D.

SIRe Project Number

2025-02-18

(will be assigned by SIRe)

Project Details (The research problem must clearly indicate the need for an interdisciplinary approach)	
Project Title	Radical and plasma-controlled sputtered metal doped hydroxyapatite coatings for in-vitro study of antibacterial efficacy of dental biofilms and biocompatibility
Project Summary (Minimum 500 and maximum 2000 characters)	Plasma is an ionized state of matter consisting of electrons, ions, neutrals, radicals, and radiation, including UV light. Non-equilibrium low-temperature and low-pressure plasmas (NELPP) using the magnetron sputtering (MS) technique have been a basis for numerous industrial applications. Among different societal applications, they have demonstrated their suitability in nanoscience, biology, and medicine. This proposal involves the development of plasma processes for the deposition of biomaterials for dental care. There is a rising concern about bacterial infection after making dental implants. Different biomaterials have been proposed to reduce the occurrence of implant-linked infections. Though hydroxyapatite (HA) is the most common material, it suffers from the limitation of antibacterial resistance. Concerning the applications, HA involves a tailor-made structure for its interaction with biological specimens. Silver (Ag) could be a choice to inhibit a wide spectrum of microorganisms and pathogenic bacteria. The NELPP device will be used to deposit suitable biocompatible materials, e.g., hydroxyapatite (HA) and silver (Ag)/HA coatings. Multilayer Ag/HA coatings of different thicknesses will be characterized to achieve efficient biological (antibacterial and biocompatible) response, with the control of plasma parameters and radicals by in-situ plasma monitoring tools, required for the optimization of the deposition process. It proposes to demonstrate in vitro antibacterial activity and in vitro cytotoxicity of Ag/HA coatings. The utility of plasma processes for the development of biocompatible materials and their efficacy in the suppression of biofilms (which are the root cause of dental diseases) for dental care will be explored for their commercialization in Indian healthcare. 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 of IIT Delhi and Co-PI at AIIMS.

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)
Supervisor 1*	Bibhuti Bhusan Sahu	Department of Energy Science and Engineering, IITD	bbsahu@dese.iitd.ac.in
Supervisor 2	Dr. Prabhat K. Chaudhari	Centre for Dental Education and Research, AIIMS, New Delhi-110029	dr.prabhatkc@gmail.com

*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)

Candidate with his/her own fellowship.

Role of Faculty Members involved:	
Supervisor-1	Design and development of plasma process and supervise for Plasma processing of material
Supervisor-2	Supervision of bio analysis and healthcare study.

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.**