Government of India
Department of Atomic Energy
Indira Gandhi Centre for Atomic Research
Kalpakkam

ADVERTISEMENT NO. IGCAR/04/2023

SELECTION OF RESEARCH ASSOCIATE

NUMBER OF RESEARCH ASSOCIATE FELLOWSHIPS: 10 (INDICATIVE)

OPENING DATE: 14-09-2023   **CLOSING DATE: 13-10-2023**

If You Have A Desire To Innovate! We Have An Opportunity To Stimulate!! Come....... Join Hands!!!
We provide the means to realize your dreams towards seeking an excellent scientific pursuit.

Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam is a premier research institute dedicated to the development of robust fast reactor technology based on intense multi-disciplinary research. IGCAR is empowering young, talented and motivated researcher's to contribute to R&D in frontier areas of engineering/scientific research and cutting-edge technologies by offering Research Associate Fellowships.

Applications are invited from interested candidates for the position of 10 (indicative) Research Associates in the Department of Atomic Energy, tenable at IGCAR for a maximum period of three years. IGCAR offers a unique opportunity to carry out research under the guidance of renowned scientists and possesses ambience of an academic institute coupled with an advanced R&D infrastructure in a mission mode. It provides the best ambience, motivation and development prospects for young Doctorates/Post Graduates in Engineering, in their professional endeavors. Endowed with scenic beauty and serene surroundings, IGCAR offers the right ambience for the pursuit of academic research.

The vibrant research and developmental activities of IGCAR encompass a wide spectrum of fields including, Thermal Hydraulics and Structural Mechanics, Design of Critical Components, Modeling Studies, Post-accident Safety Analysis, Wireless Networking, Parallel Computing, Embedded and Simulator Systems, Non-destructive Evaluation and Reliability, Chemical Process Design and Modeling etc. State-of-the-art infrastructure is available at IGCAR for carrying out excellent research.

Facility for submission of online application will be available from 14/09/2023 to 13/10/2023 on Recruitment page of IGCAR website i.e. http://www.igcar.gov.in/recruitment.html.

The Application form generated online must be forwarded along with supporting documents to **Assistant Personnel Officer (R), Indira Gandhi Centre for Atomic Research, Kalpakkam-603102** superscribing *"Research Associate-<Project Code>-<Application No.>"* on the envelope so as to reach IGCAR on or before 18/10/2023. In addition to sending by post, scanned copy of signed application form & supporting documents must be sent by email to ***shure@igcar.gov.in*** with subject as *"Research Associate-<Project Code>-<Application No.>"*.

At IGCAR, we believe in 'EXCELLENCE WITH RELEVANCE'.
Our strengths are the highly stimulating and scholarly environment, knowledge
and motivating faculty and state-of-the-art facilities

AREAS OF RESEARCH PROJECTS

Chemical Sciences

Project Code: PC-01	
Name of the Research Project	Computational Studies on the Interactions of Lanthanides and Actinides with Various Molecules towards Reprocessing applications
No. of vacancy	1
Qualification	PhD in Physical chemistry (expertise in Computational Chemistry) with experience in calculations of transition metals / lanthanides / actinides
Field of work	Density Functional Theory Calculations on Metal Complexes / Molecular Dynamics Calculations / Solid State DFT Calculations
Nature of work	The successful candidate will be investigating electronic structure of Lanthanide/Actinide metal complexes, their properties in solutions and modeling interactions of metal ions with various materials and molecules. Applicants must be independent, be able to handle multiple projects, and be expert in electronic structure computational packages and theoretical analysis. Applicants should have reasonable programming skills (e.g. C, Python, etc.)

Project Code: PC-02	
Name of the Research Project	Exploration of Pnicogen and Tetrel Bonding Interactions using Matrix Isolation Infrared Spectroscopy
No. of vacancy	1
Qualification	PhD Physical Chemistry (expertise in Spectroscopy)
Field of work	Low temperature infrared spectroscopy under isolated conditions; application to solvents of reprocessing application
Nature of work	Characterization of pnicogen and tetrel bonding interactions in many prototypical systems; matrix isolation spectroscopy of molecules; probing intermolecular interactions with IR Spectroscopy;

Project Code: PC-03	
Name of the Research Project	Electrochemical Impedance Spectroscopy Investigations of Metal Alloys in LiCl-KCl Eutectic Melts
No. of vacancy	1
Qualification	PhD (Chemical Sciences preferable physical chemistry)
Field of work	High temperature electrochemistry, molten salts, cyclic voltammetry, and electrochemical impedance spectroscopy, electrode kinetics, equivalent circuit modeling
Nature of work	The work involves carrying out high temperature electrochemical measurements in molten salts (400-500 °C), assembling/ disassembling of electrodes in inert atmosphere glove boxes, standardization of electrode design, preparation of LiCl-KCl eutectic melts having different levels of purity and data analysis / modeling of complex impedance data using equivalent circuit models

Project Code: PC-04	
Name of the Research Project	Synthesis and characterisation of Magnesium Aluminate thin film on SS 316LN by Pulsed Laser Deposition
No. of vacancy	1
Qualification	Ph.D in Physics / Materials Science
Field of work	Experimental: Synthesis and characterisation of Magnesium Aluminate thin film on SS 316LN by Pulsed Laser Deposition; Microstructural and nanomechanical property evaluation
Nature of work	Core catcher (Main Vessel) collects the core debris during core melt down which is made up of SS 316LN. Sacrificial layer of magnesium aluminate on SS 316LN is proposed to restrict the temperature at the core catcher bottom. To meet this requirement, $MgAl_2O_4$ thin film is to be synthesized on SS 316LN substrate by Pulsed Laser Deposition technique optimizing the process parameters. The candidate will investigate thoroughly the optical, micro-structural and nano-mechanical properties of the films to analyse the quality of thin films. The sodium compatibility of $MgAl_2O_4$ thin film/ SS is to be performed by the candidate in static/dynamic sodium pool to simulate the real condition.

Project Code: PC-05	
Name of the research:	Localized Raman characterization for chemical sensing
No. of vacancy	1
Qualification	PhD in Physics/Materials Science Engineering disciplines (thesis submitted also encouraged to apply) with first class grade in MSc/M.Tech
Field of work	The candidate will be expected to perform Raman spectroscopic measurements; Characterize the sensor materials using surface probe microscopy, namely Atomic Force Microscopy (AFM), Scanning Tunnelling Microscopy (STM)
Desired skills	Growth of noble metallic nanostructures, Surface enhanced Raman spectroscopic analysis, Vacuum handling, and Chemical safety

Project Code: PC-06	
Name of the Research Project	Atomistic imaging and simulation of structure and chemistry of FBR structural materials using Aberration corrected TEM
No. of vacancy	1
Qualification	Ph.D in Materials Science/ Materials Engineering/ Physics
Field of work	TEM and STEM based imaging, EDS and EELS Analysis, Materials Modelling and Simulation
Nature of work	Advancement of the electron microscopy, especially the development of different STEM based detectors; enable us to extract the materials related information down to the atomic level for the entire range of periodic table. Comprehensive understanding of the aberration-corrected STEM-HAADF, STEM-iDPC images including EELS analysis as well demands simulation of the images using different computational approaches. During the consolidation process of the 9Cr and mid-Cr ODS steel through powder metallurgical route, Y_2O_3 undergoes solid state reactions with the Ti present in the matrix and forms different non-stoichiometric complex oxides as the derivatives. Understanding the site substitution behaviour of the Y and Ti demands the aberration-corrected atomic resolution STEM-HAADF imaging including structure modelling and image simulation. Similarly, the

distribution the energetically favourable C sites in the WC structure as well the formation of defect formation probability demands atomic resolution STEM-iDPC imaging including image simulation to detect the C atoms. The defect formation behaviour of the mechanically milled yttria and the high B content steel are crucial to understand their behaviour in-operando and needs the understanding from the experimental and theoretical characterization in hand-to-hand. Structural analysis of the FBR related materials using materials modelling would be studies as a complementary to the atomic resolution STEM characterization.

Engineering Sciences

Project Code: PC-07	
Name of the Research Project	Corrosion-resistance evaluation of ceramic coatings and structural materials in molten lead for Gen-IV lead based fast reactors.
No. of vacancy	1
Qualification	PhD in Metallurgy/Chemical/Chemistry/Mechanical or a related discipline.
Field of work	Future generation advanced nuclear reactors focuses on the heavy liquid metals (lead, lead -bismuth and lead-lithium eutectic systems) coolant because of its thermal and neutronic properties. However, concern is raised for the heavy lead metal compatibility with structural materials in terms of corrosion and mechanical properties. The projects deals with investigating the corrosion issues of structural materials in the molten lead environments and developing advanced surface modification methods on structural materials for lead cooled fast reactor applications.
Nature of work	The research associate will be responsible for performing corrosion investigations of candidate materials for molten lead applications. The work focused on developing the most promising liquid metal corrosion (LMC) mitigation approaches viz., surface alloying, oxide coating and aluminizing which aim to suppress their adverse influence on material performance annnd includes the following: • To understand and compare the corrosion mechanisms of structural materials (P-91 steel, 316LN SS and ODS materials) in pure lead, and Pb-Bi eutectic systems in static and dynamic testing. • To develop the corrosion resistant coatings on structural materials to mitigate the adverse influence of molten lead on material performance.

Project Code: PC-08	
Name of the Research Project	Automation of Defect Characterization in Active Thermography Techniques Using AI Based Approach
No. of vacancy	1
Qualification	**Ph.D. in** Computer Science/Information Technology/ECE or a relevant discipline **Experience:** The candidate should have a adequate theoretical and experimental knowledge of various ML/DL approaches and should be well versed with open source programming languages like Python. The candidate should adopt appropriate new and novel AI models to achieve the goal.
Field of work	Machine Learning, Deep Learning and Artificial Intelligence
Nature of work	In various industries, like aerospace, power sector, Non Destructive Evaluation (NDE) is widely used to detect and characterize defects in structural material, increase its life span and to prevent the accidents. Active thermography is one of the advanced NDE methods widely used for such defect characterization, measuring the coating thickness and thermal properties of materials. The two important active thermography techniques are Pulsed Thermography (PT) and Lock-in Thermography (LT) techniques. They have the advantages of being non contact in nature with fast inspection rate and large area scanning ability. Automation is a process or method used to perform multiple tasks with minimal or without human intervention. In any NDE technique, it is important to automate the process of defect characterization. This will enhance the quality, reliability, and reduce the cost. Artificial Intelligence (AI) plays crucial role in automation. Machine Learning algorithms are deployed in many automation processes by training and testing the algorithm with appropriate database. The main aim of the work is to automate the defect detection and estimation of its size, shape and location in PT and LT using Machine and Deep Learning approaches. In PT and LT, a 3 dimensional temperature based spatio-temporal database is generated during the experiment. In this proposed work, various image processing approaches will be adopted for removing noise, unwanted region removal, data dimension reduction etc. The database generated from various standard samples will be subjected to training and testing using various ML and DL algorithms to automate the defect detection and depth and size quantification process. The final outcome of the proposed work will be an interface which can load the raw data and perform automated evaluation on it.

Project Code: PC-09	
Name of the Research Project	Establishment of n-TOF system for neutron cross section measurement using Am-Be fixed neutron source
No. of vacancy	1
Qualification	PhD (Physics / Nuclear Science / Nuclear Engineering)
Field of work	Scintillation/Semiconductor detector modelling, neutron time-of-flight (n-TOF) simulation using deterministic or Monte Carlo methods, specification and design of the neutron cross section measuring experimental system. Nuclear reaction theory and use of nuclear model codes such as EMPIRE and TALYS desirable.

Nature of work	The primary responsibility of Research Associate will be to participate in the on-going activities of development of nTOF system for neutron interaction cross section measurements. The responsibility would be specifying neutron and gamma detectors, source configuration and associated electronics and data acquisition systems, etc. Post-experimental analysis of the results and comparison with model predictions using EMIPRE and TALYS

Life Sciences

Project Code: PC-10	
Name of the Research Project	**Study on Radiation Effect In Non-Human Biota to Reevaluate the Applicability of LNT Model in Case of Low Dose Ionizing Radiation**
No. of vacancy	1
Discipline	Ph.D. in Life Sciences/Zoology/ Biological Sciences
Field of work	LNT model at low level radiation, Low Dose Ionizing Radiation (LDIR)
Nature of work	The history of cancer risk assessment based on LNT theory was established based on certain falsified assumption of initial mutation studies on *Drosophila*. However many later case studies on human have shown support for threshold model. Similarly some studies on low dose ionizing radiation (LDIR) showed many positive effects, such as hormesis and similar adaptive response, in the living system. At the same time concept of bystander effect, dose-rate consequences on chromosome is less understood in case of LDIR. In this scenario the effect of various types of radiation at low level on non-human models such as *Drosophila* can help us to understand the applicability of LNT model at low level radiation. This studies will help us to understand the LDIR induced expression of carcinogenic markers at multiple stages of development as well as at multiple generations. **Aim:** • To evaluate the biological effect of LDIR at different developmental stages of *Drosophila*. • To evaluate the hormesis immune response to LDIR. • To evaluate Radiation-induced bystander effects in drosophila. • To evaluate the expression of radiation induced markers in multiple generations.

1. **Eligibility Criteria:**

The upper age limit for applying for award of Research Associate shall be 35 years.

2. **Selection Procedure:**

Selection will be on interview basis only. Applications received will be subject to screening. Only screened-in candidates will be interviewed at Kalpakkam. All information related to the selection will be made available on the website i.e. *http://www.igcar.gov.in/recruitment.html*. Candidates are advised to visit the website periodically for information and updates in this regard. Information displayed on the website will be deemed as intimation to the candidates.

3. **General Instruction:**

   i. Before applying, the candidate should ensure that he/she fulfills all the eligibility conditions mentioned in the advertisement. Candidates should ensure that they fill in the correct information. Furnishing of incomplete, false or misleading information shall render the application liable to be rejected. Only a summary scrutiny of the application would be made before the final stage of the selection process and detailed scrutiny of the eligibility of the candidate would be done only at the final stage of the selection process. As such, the candidature of the applicant shall remain provisional till detailed scrutiny is undertaken and the candidate is found eligible in all respect. IGCAR would be at liberty to reject any application at any stage of the selection process if the candidate is found ineligible for the post or if it comes to notice that the candidate has furnished false information. The decision of IGCAR shall be final in deciding the eligibility of the candidate. The mere fact that a call letter has been issued to the candidate and allowed to appear in the interview will not imply that his/her candidature has been finally cleared or that entries made by the candidate in his/her application have been accepted as true and correct.

   ii. Age, qualification, experience, community status, creamy layer status will be reckoned as on the closing date for submission of application online.

   iii. Those candidates who are in employment under any Central/State Govt./Public Sector Undertakings/Corporations/ Local Govt. etc. should submit a No Objection Certificate from the employer at the time of verification of the documents.

   iv. Candidates who are NOT meeting the mentioned qualification NEED NOT apply.

   v. The period of service rendered as research fellow will not be counted in any post of DAE / Other Government Department

4. **Amount of Fellowship:**

RA-1: Rs. 47,000/- p.m. plus contingency Grant of 40,000 per annum
RA-2: Rs. 49,000/- p.m. plus contingency Grant of 40,000 per annum
RA-3: Rs. 54,000/- p.m. plus contingency Grant of 40,000 per annum

Note:-

A) The Research Associates will be fixed at one of the 3 fellowship as indicated above depending on qualifications and experience. The level at which a fellow will be placed will be decided by the interview committee based on the following;

   a. Quality of Ph.D. Thesis

b. Post-Ph.D. Research experience as evidenced from the quality of the publications and/or products processed designed and developed

c. Performance in Selection Interview

B) The Department does not grant any such fellowship to the scholars who have submitted Ph.D. thesis and are awaiting evaluation of thesis.

C) A Person with Provisional/Regular Ph.D. will be treated at par with Research Associates and will be eligible for fellowship as per extant rates.

5. Tenure of Associateship:

The selected candidates will be initially taken for a period of **two years**. On satisfactory performance, the tenure of associateship will be further extended by **one more year.**

6. Medical:

The selected candidates are eligible to join the Contributory Health Service Scheme of DAE as applicable.

7. Accommodation:

The Selected candidates will be provided with subsidized bachelor Hostel Accommodation or family accommodation in specially deserving cases during the tenure

8. How to Apply:

i. Facility for submission of online application will be available from **14/09/2023 to 13/10/2023** on Recruitment page of IGCAR website i.e. ***http://www.igcar.gov.in/recruitment.html.***

ii. Applications will be accepted only through online mode. Candidate should read the instructions in the advertisement and online application form carefully before making any entry or selecting any option.

iii. Before filling application form, candidates should keep ready the necessary documents / certificates required. Candidate is required to fill up personal and qualification details and while filling up the online application form candidates should ensure that all the required details are entered correctly.

iv. A valid e-mail ID and Mobile Number is mandatory for submitting application online and email ID should be kept active till the declaration of results. IGCAR will send call letter for Interview to the registered / given e-mail ID or candidates may be required to download from the website. No correspondence will be sent through post/courier.

v. Before clicking the submit button, the candidate is advised to check and ensure that all the details filled in are correct. Candidate may also ensure that name, date of birth, etc. are entered correctly in the application form as per Secondary School Certificate (SSC). Any incorrect information may disqualify candidature. After final submission of application no request for change / correction in any of the information in the application form shall be entertained under any circumstances.

vi. Candidates are requested to take a printout of the application form generated by the system and forward the same along with supporting documents to **Assistant Personnel Officer (R), Indira Gandhi Centre for Atomic Research, Kalpakkam-603102** superscribing *"Research Associate-<Project Code>-<Application No.>"* on the envelope so as to reach IGCAR on or before 18/10/2023. In addition to sending by post, scanned

copy of signed application form & supporting documents must be sent by email to *shure@igcar.gov.in* with subject as *"Research Associate-<Project Code>-<Application No.>"*.

vii. The number of associateship indicated in this advertisement is approximate and may vary as per the requirement from time to time. The Centre reserves the right not to fill up the associateships any time if it so desires.

viii. The associateship shall not confer any claim or right for regular employment in the Centre or any Unit of Department of Atomic Energy. Opportunities exist for meritorious candidates to take up position of Visiting Scientist / KSKRA Fellowships.

ix. Admission shall not be claimed by any candidate as a matter of right. The admission shall be entirely at the discretion of the selection committee, which may refuse to admit any candidate without assigning any reason thereof.

x. No correspondence whatsoever form will be entertained from candidates regarding reason for not being called for interview/outcome of interview.

xi. Corrigendum/Addendum, if any, pertaining to this advertisement will be uploaded only on IGCAR website.

xii. The Final induction of the selected candidates as Research Associate will be subject to production of all necessary document in original (Proof of Date of Birth, B.Sc., M.Sc./B.E./B.Tech./M.Tech./Ph.D. degree and Mark Sheets) on the date intimated to them by the Department.

xiii. For any clarification candidate may please contact by email: *shure@igcar.gov.in*

9. Cancellation of the candidature:

Candidate is cautioned not to furnish any incomplete, false or misleading information or submit any document which is defective, forged or fabricated or otherwise not admissible or claim fraudulently SC/ST/OBC/Person with Disability status etc., or resort to any sort of malpractice during the selection process. Notwithstanding verification of original documents during various stages of the selection process, if any such case is detected at any stage of the selection process or later on, this Centre reserves the right to withdraw/cancel candidature or selection apart from taking other appropriate legal action.

Candidates will not be allowed to appear for the interview if they fail to bring a copy of the Application and a valid photo identity card (such a Voter ID, Driving License, AADHAR Card, Passport, College ID) and all the documents in original at the time of interview.

ANY LEGAL DISPUTES ARISING OUT OF THIS NOTIFICATION ARE SUBJECT TO CHENNAI JURISDICTION ONLY. IN CASE OF ANY DISPUTE, ENGLISH VERSION OF DETAILED ADVERTISEMENT PLACED ON IGCAR WEBSITE (HTTP://WWW.IGCAR.GOV.IN) SHALL BE REFERRED.

RECORD OF THE NON-SELECTED CANDIDATES SHALL NOT BE PRESERVED BEYOND 6 MONTHS FROM THE DATE OF PUBLICATION OF SELECT LIST.

CANVASSING IN ANY FORM WILL BE A DISQUALIFICATION.

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11/9/2023