Chaire de professeur junior
Fiche profil de poste

Organisme : University of Limoges (UNILIM)
Working site : Limoges – Institut de Recherche sur les CERamiques (IRCER) UMR CNRS 7315
Academic region : Limoges

Teaching component : ENSIL-ENSCI

Keywords: Artificial intelligence, big data, signal treatment, ceramic materials, surface treatment, processing, 3D printing, industry 4.0, atomic-scale modelling.

Contract period : 6 years

Scientific field: Digitization of ceramic processes and surface treatments

Corresponding CNU/CoNRS/CSS sections : CNU 33, 62 / CoNRS 15, 10, CID 55

Profile to publish :
We are looking for an "Enseignant-chercheur" with an expertise in artificial intelligence and an experience in at least one of the following areas: massive data processing, signal processing, digitization of processes (ceramics, plasmas and/or lasers), modeling of physicochemical properties of materials (at the atomic and mesoscopic scales, thermodynamics and/or by discrete elements)

Teaching: The candidate should be able to intervene at the level of the engineering cycle as well as the integrated preparatory cycle of the ENSIL-ENSCI engineering school in particular in the fields of artificial intelligence, material science, chemistry, physics and computer science.

Research: The person recruited will lead scientific projects within the framework of the research activities of one of the four axes of the IRCER on the development and application of artificial intelligence in connection with one of the following themes
- digitization of processes related to ceramic materials
- the modeling of the behavior of the material
- modeling of the physico-chemical properties of ceramic materials
- signal processing and massive data

Job Profile
Full associate professor position with teaching in artifical intelligence, material science, and general physics/chemistry within the Engineer School (ENSIL- ENSCI).

Research profile
Research in artificial intelligence applied to ceramic materials within the IRCER laboratory

Teaching :

Teaching department :	ENSIL-ENSCI
Location :	Ester Technopole
Teaching category:	Cycle préparatoire intégré – FIMI et Tronc Commun du cycle ingénieur.
Teaching Contact:	Joanny Stephant
Teaching Contact phone:	0555423705
Teaching Contact Email:	joanny.stephant@unilim.fr
Department URL:	https://www.ensil-ensci.unilim.fr/formations/
Description of the teaching department : Public and transdisciplinary school, part of the University of Limoges, ENSIL-ENSCI delivers the engineering diploma in 6 specialties (https://www.ensil-ensci.unilim.fr). Located in the ETSER technopole in Limoges, it is at the heart of a very rich ecosystem. Based on excellent research activities (ceramics, surface treatment, biotechnologies; electronics; optics and microwaves; mechatronics, etc.), it prepares students for the various facets of the engineering profession, which must combine scientific and technical skills, international exposure, management skills, know-how and interpersonal skills. It welcomes 850 students from post-baccalaureate level to engineer level. It has a network of more than 5,000 alumni around the world.	

Recherche :

Name of the research group:	Axe 1, 2, 3 ou 4 de l'IRCER UMR7315
Place:	Limoges
Research contact:	Philippe Thomas
Research contact phone:	05 87 50 24 07
Research contact email:	philippe.thomas@unilim.fr
URL du laboratoire :	https://www.ircer.fr/
Description of the laboratory: IRCER (UMR 7315) is a multidisciplinary laboratory working on materials science and process engineering, as well as on the combination of fundamental and applied approaches, aiming to understand, characterize, control and model the various processes and physicochemical properties of ceramic materials. IRCER is organized into four complementary research axis and federates a group of more than 200 teacher-researchers, CNRS researchers, engineers, technicians, post-doctoral students, doctoral students and administrative staff. Axis 1 (ceramic processes) develops innovative processes adapted to the challenges of manufacturing ceramic objects with controlled architecture and nano-micro-structure. Axis 2 (plasma and laser processes) develops processes integrating fundamental and applied research at the interface of plasma process physics and condensed matter physics until the realization of functional objects. Axis 3 (Multiscale structural organization of materials) works on the improvement of existing properties or the discovery of new properties of	

ceramic materials according to a scientific approach that corresponds to the classic triptych "synthesis/structure/properties". Finally, axis 4 (ceramics under environmental constraints) works on the design of ceramic materials with original properties that meet targeted conditions of use, particularly in biology.

Activities description:

This position is offered as a fixed-term contract (CDD) under public law for 6 years with a view to tenure in the body of University Professors according to the Junior Professorship procedure (Decree No. 2021-1710 of December 17, 2021 relating to the Junior Professorship contract provided for in Article L. 952-6-2 of the Education Code and in Article L. 422-3 of the Research Code)

Pedagogy:
The person recruited will be in charge of developing an acculturation to artificial intelligence at the ENSIL-ENSCI school within all specialties. He/she will be in charge of transmitting his/her competences in particular in artificial intelligence, chemistry, physics and computer programming, for the integrated preparatory cycle called FIMI (Formation Initiale aux Métiers d'Ingénieur) of the ENSIL-ENSCI (students of Bac+1 and Bac+2), and for the Common Core of the engineering cycle.
Because of his/her research work and possible relations with industrial partners, the person recruited will have to propose and supervise internships and tutorials for training courses related to his/her research activities. The person recruited will also be required to ensure the dissemination of scientific culture around the themes of artificial intelligence and its application to the study of ceramic materials in order to develop awareness among engineering students, masters students, doctoral students and permanent staff of ENSIL-ENSCI and IRCER.
Beyond his or her teaching activities, the person recruited will be an actor in the school's training courses, he or she will have to possess human qualities and an open-mindedness that are essential to awaken a creative technical culture in students as early as possible, but also a taste for entrepreneurship.
The person recruited will be able to benefit from a statutory reduction of teaching activities.

Research:
Depending on the candidate's profile, the project will focus on one of the following themes:

1- The consolidation of the digital chain is at the heart of IRCER's ambitions. The current issues related to the digital chain are common to ceramic processes, surface treatment processes, and the automation of material characterization, three aspects considered as the core business of the laboratory. The full exploitation of this digital chain requires in particular a monitoring (in real time) of all the steps of the processes. The data provided by networks of sensors (i.e., big data) allowing on the one hand to control the processes according to optimization strategies exploiting artificial intelligence (AI of machine learning type) and, on the other hand, to carry out balances material/energy/cost in a perspective of analysis of the life cycle (LCA) in connection with the sustainable development.

In general, the laboratory has a large number of diagnostic techniques allowing to produce massive data such as: X-ray diffraction data, spectroscopic data, time-frequency spectrograms of signals, spectral images of plasma, images obtained by umbroscopy or structural or microstructural images of deposits. These data will be used to develop deep learning methods based on neural networks, which will allow to optimize the processes and to automate the characterizations by establishing the relationship between operating parameters - structure/microstructure - properties.

The main objective of the project is to develop a complete platform for manufacturing and characterization of advanced ceramics integrating forming and consolidation technologies with machine learning capabilities. The developments will be based on technological and numerical building blocks already under study at IRCER (e.g., additive manufacturing (AM) technologies, "pixelated" sintering furnace, X-ray diffraction platform, plasma process technologies).

2- IRCER is developing an activity of modeling and numerical simulation of materials and their properties at different space-time scales. At the macroscopic scale, original numerical methods based on the Discrete Element Method (DEM) are used to study the relationships between the microstructure and the macroscopic thermomechanical properties of refractory ceramics. Also, thermodynamic modeling (CALPHAD method) allows the calculation of phase diagrams of ceramic materials and thus access to their behavior under thermodynamic constraints. From the mesoscopic to the microscopic scale, modeling at the colloidal scale (Brownian dynamics, molecular dynamics) and at the atomic scale (DFT, molecular dynamics) allows to model the microscopic structure of glassy materials, glass-ceramics and ceramic colloidal suspensions and to access their structural, electronic, optical, dynamical and catalytic properties.
In this context, AI can have many applications, including the exploitation of databases of MED simulation results at the microscopic scale in order to implement "data-driven" multi-scale thermomechanical calculations or the rapid generation of meshes of complex geometry. Also, data from DFT and molecular/Brownian dynamics can be exploited to build and predict phase diagrams as well as the development of interaction potentials allowing to reach spatio-temporal scales not accessible by ab-initio modeling. Thus, learning algorithms (machine/deep learning, kernel method, development of descriptors) would make it possible to exploit the large amount of data that can be generated by different types of calculations and significantly accelerate the numerical calculation chain and thus get closer to calculation times compatible with a use in design office and industrial engineering.

The present research project aims at developing an automated approach to innovate in ceramic processes and materials by exploiting the data from the different calculation methods currently used at IRCER.

Startup package :

Human resources :	Phd student recruited on the research topic Accompaniment by a Research Director
Material resources :	Office and computer facilities IRCER and CARMALIM platform equipments Mission expenses
Financial Resources: Total amount of associated funding : Including support from the Agence Nationale de la Research (ANR)	 743468 € 200000 €

Other informations :

Specific experience requirements:	More than 3 years of experience in at least ONE of the following areas: materials science, artificial intelligence technologies, ceramic processes and surface treatment, numerical modeling, scientific computing and programming.
Methods of organizing recruitment	
Submission of application files	