

POSTDOC POSITION IN MICROBIOLOGY FOR THE DEVELOPMENT OF ANTIMICROBIAL METAL MATERIALS

- Employer: University of Pau and Pays de l'Adour (UPPA)
- Recruitment grade: young researcher (i.e., with PhD)
- Location: Pau
- Starting date: 01/01/2025
- Duration of the contract: 12 months
- Gross Salary Range: 3015 brut euros / month
- Deadline to apply: 15/09/2024

CONTEXT AND POSITION DESCRIPTION

The postdoctoral position is affiliated with the International Chair of Andrew Gellman, full Professor of Chemical Engineering at Carnegie Mellon University (PA, USA). This chair is a five year project funded by the E2S UPPA (Energy Environment Solutions) Initiative (<https://e2s-uppa.eu/en/index.html>). The international chair project is aimed at developing multicomponent materials for Energy and Environmental technologies. It is a close partnership between two academic laboratories, IPREM (Institute of Analytical Sciences and Physical Chemistry for the Environment and Materials - <https://iprem.univ-pau.fr/en/home.html>), and the College of Engineering (<https://engineering.cmu.edu/>) at Carnegie Mellon University (USA, Pittsburgh).

Touch surfaces in high human traffic areas can become vectors for disease propagation through indirect contact between infected and vulnerable persons. This pathogen transfer mechanism makes it critical to develop self-sanitizing materials which are effective against a broad range of pathogens. High-traffic surfaces are often made of metals and alloys that achieve antimicrobial activity by different mechanisms against diverse pathogens. By leveraging these mechanisms synergistically, a solid-solution alloy of these elements may be active against a range of pathogens larger than the sum of its parts, resulting in an antimicrobial super alloy.

In this context, the main objectives of the position will be dedicated to the characterization of the antimicrobial activity of multicomponent metal alloys materials in order to identify the alloy compositions with possible antimicrobial super alloy candidates.

MISSIONS

The main missions of the position will be to characterize at UPPA (Pau) the physico-chemical and antimicrobial properties of the materials prepared at Carnegie Mellon University in Pittsburgh.

These materials are prepared through a Composition Spread Alloy Film (CSAF) methodology that relies on physical vapour deposition using electron beam sources under ultrahigh vacuum (UHV) conditions¹. Several metals and metal alloys could be tested including Ag, Ni, Co or Cu... Gold single component or gold alloy surfaces could also be created as control material to assess the real cytotoxicity of the antimicrobial metals of interest.

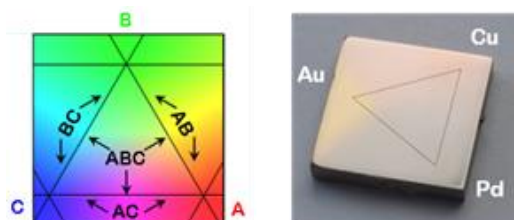


Figure 1 (left) Schematic illustration of a library of CSAF materials containing regions with pure A, B, and C, regions that span all three binary alloy composition spaces, and a triangular region that contains all possible ternary alloy compositions. (right) Picture of a 100 nm thick CuAuPd sample deposited on a 14x14 mm² Molybdenum substrate.

The antimicrobial activity will be evaluated through two approaches. First, bacterial adhesion on metal surfaces will be assessed by fluorescence microscopy, using *Pseudomonas fluorescens* and *Shewanella oneidensis* as model bacteria. The second approach will be to measure the antimicrobial activity of the metal surface through assays in solution using *Escherichia coli* and *Bacillus subtilis* as gram negative and gram-positive bacteria models. The main goal would be to evaluate the probable toxicity of the materials throughout metal ions release mechanisms.

The characterization of the adhesion properties will be evaluated by Scanning Auger Mapping (SAM) and Time-of-Flight Secondary Ions Mass Spectrometry (ToF-SIMS) imaging in order to establish a correlation between the chemical composition of the metal alloys and the amount of bacteria cells adhering to the surface. In addition, fluorescence microscopy and flow cytometry will be implemented through live and dead cell labeling methods using suitable dyes in order to evaluate the cytotoxicity both through adhesion and solution-based assays.

1 .C. Ferris, N. Golio, H. Martinez and A. J. Gellman, *Chem. Commun.*, 2023, **59**, 8660–8675.

TASKS AND MAIN RESPONSIBILITIES

The candidate will be in charge of different tasks and responsibilities including :

- The characterization of bacterial growth, adhesion and antimicrobial activity using classical microbiology technics and epifluorescence microscopy
- The imaging and the physico-chemical characterization of materials surface Scanning Electron Microscopy, Auger spectroscopy and ToF-SIMS spectrometry
- Organization of meetings, reports and publication writing in strong interactions with our US partner

REQUIRED QUALIFICATIONS AND SKILLS

The candidate should have the following skills and expertises :

- A PhD in microbiology
- A strong experience in bioimaging and/or imaging of cells or bacteria (SEM, fluorescence microscopy...)
- Knowledge of spectroscopy and spectrometry techniques is appreciated.
- Autonomy, dynamism, creativity, english fluent and good communication skills.

APPLICATIONS AND DEADLINE

- The deadline for submitting the application is 15/09/2024.
- Please submit your application by email to joachim.allouche@univ-pau.fr, sophie.nolivos@univ-pau.fr, regis.grimaud@univ-pau.fr
- Please attach the following documents as a single PDF file with your application : CV, motivation letter, a brief description of research interests, a contact information for at least one professional reference...
- For additional information please contact: joachim.allouche@univ-pau.fr