Post-Doctoral position (1 year) 2017-2018

Multiscale modeling of copper by a self consistent approach. Application to Printed circuit boards.

Laboratory

Université de Lorraine, LEM3 Laboratoire d'Étude des microstructures et de mécanique des matériaux (UMR CNRS 7239)
Ile du Saulcy
F-57045 Metz - Cedex 01
Site Web: http://www.lem3.fr

Main Goal

The LEM3 laboratory and the SME CIMULEC have created a virtual laboratory to develop research on Printed Circuit Boards (PCB), see (LEMCI web site)

A printed circuit board is a passive component which allows to interconnect electronic components soldered on the outer layers in order to realize a complex electronic system. It is a complex multi-layer assembly developed for a very specific goal which requires expertise in mechanical and material sciences. In order to reach the expected performance and lifetime in harsh environments dedicated high-performance base materials are required. During its lifetime, the PCB undergoes a large number of thermal cycles which can lead to the breakup of copper pathes.
We will investigate the macroscopic response of copper path, based on a multiscale strategy [1]. Within this context, we will develop a research on mean field approach and with a self consistent scheme, the macroscopic behavior of copper will be derived. The model has to handle cyclic loading, since a PCB is facing thermal cyclic loading. The candidate could also have the opportunity to develop finite element calculations based on crystal plasticity. Experimental data on copper used in PCB will be available.

Work to be done

The candidate must develop a self consistent scheme for elastic –viscoplastic materials. We focus mainly on copper material. He (she) will propose the development of the polycrystalline model, dedicated to copper, based on a tangent additive interaction law. The model will have to handle cyclic loading. The validation of the model will be performed based on copper materials used in real PCB. The work will be in collaboration with K. KOWALCZYK-GAJEWSKA, in IPPT Warsaw.

Gross salary :

44000 euros per year (around 2000 euros per month net). It exists some flexibility depending on the research experience of the candidate.

Profile

We are looking for highly motivated scientists with a phd degree in mechanics of materials with the following profile: good organizational and communication skills., proactive attitude and ability to work both independently/autonomously and within a team, good communication skills in English. Owing the research activities during the post doc position, some experiences on multiscale approaches and experiences in finite element calculations are needed. Good capability in programming (Fortran for instance).

The candidate will interact with members of LEM3 but also with phd students working on the topic of reliability of PCB.

Duration of the contract :

12 months, possibility of extension.

The position is actually open.

Contact persons

S. MERCIER (Professeur - LEM3)
sebastien.mercier@univ-lorraine.fr
+33 (0) 3 87 31 54 89

M. Martiny (Professeur - LEM3)
Marion.martiny@univ-lorraine.fr
+33 (0) 3 87 31 54 09

References :

1. MERCIER S., MOLINARI A., Homogenization of elastic-viscoplastic heterogeneous materials: Self-consistent and Mori-Tanaka schemes, *Int. J. Plasticity*, **2009**, vol. 25, pp. 1024-1048
2. MERCIER S., BERBENNI S., MOLINARI A., BERVEILLER M., Comparison of different homogenization approaches for elastic-viscoplastic materials, *MODELLING AND SIMULATION IN MATERIALS SCIENCE AND ENGINEERING* , **2012**, vol. 20
3. CZARNOTA C., KOWALCZYK-GAJEWSKA, SALAHOUELDJ A., MARTINY M., MERCIER S., Modeling of the cyclic behavior of elastic-viscoplastic composites by the additive tangent Mori-Tanaka approach and validation by finite element calculations, IJSS, **2015**, vol. 56-57, pp 96-117
4. Msolli, S.; Martiny, M.; Cardoso, M. Costa; Pessanha Moreira, L.; Mercier, S.; Molinari, A., Numerical modeling of the deformation of AISI 304L using a tangent additive Mori-Tanaka homogenization scheme: Application to sheet metal forming, JOURNAL OF MATERIALS PROCESSING TECHNOLOGY, 235,187-205