iemn
Institut d'Electronique, de Microélectronique et de Nanotechnologie
UMR CNRS 8520

Master and Engineer Internship 2024-2025

Proposed by : Jean-François ROBILLARD, Etienne BLANDRE, Pascale DIENER
Phone number : 03 20 19 79 17
E-mail : jean-francois.robillard@iemn.fr ; Etienne.blandre@junia.com ; pascale.diener@junia.com
Research group : Silicon Microelectronics

Title : Nanothermal study of Mott materials for the realization of neuromorphic components

Summary. Small-gap Mott materials, such as V_2O_3 and GaV_4S_8, are unconventional semiconductor materials whose electrical conductivity varies abruptly with the application of electrical pulses. This electric field-induced phase transition is being exploited in the development of single-component artificial neurons and synapses, which could revolutionize the design of future ultra-low-power artificial intelligences. To optimize the performance of these components, it is necessary to study the thermal properties of candidate materials at the nanometric scale. The aim of this internship is to measure the thermal conductivity of V_2O_3 thin films with different levels of electronic conductivity, using IEMN's advanced equipment. In particular, the thin films will be studied using a thermal microcopy technique called SThM (Scanning Thermal Microscopy) derived from atomic force microscopy.

Resources and tools. IEMN is a research institute with 450 teaching and research staff, engineers, technicians and students on 4 sites. The central laboratory is organized around two technology platforms: the Centrale de Micro-Nano-Fabrication (CMNF), with 1950 m² of clean rooms and platforms dedicated to micro and nanotechnologies, and the Plateformes de Caractérisation Multi-Physique (PCMP), which combines microscopy, physical analysis, electrical, radio frequency, EMC and telecommunications techniques. For this internship in particular, the candidate will have access to Raman thermometry, thermal near-field microscopy and a 3 omega thermal characterization bench for thin films.

Network collaborations. This internship is offered as part of a collaboration between IEMN's Silicon Microelectronics and Physics groups, in partnership with IMN in Nantes. The candidate will be remunerated by the CNRS and will work at the IEMN central laboratory in Villeneuve d'Ascq.

salary. ~ 660€ / month

Ph.D. opportunity. Yes, subject to funding availability and internship results.

Skills. currently studying at Master 2 level or equivalent, the candidate should have knowledge in one or more of the following fields: semiconductor devices, correlated electronic systems, atomic force microscopy, modeling tools for multi-physical systems, etc.

Duration. 6 months from February or March 2025