Université Lille Nord de France

Ecole doctorale régionale Sciences Pour l'Ingénieur
Lille Nord-de-France - 072

Titre Thèse	High frequency switch based on 2D materials		
(Co)-Directeur	Henri Happy	E-mail : henri.happy@univ-lille.fr	
(Co)-Directeur		E-mail :	
(Co)-encadrant	Emiliano PALLECCHI	E-mail : emiliano.pallecchi@univ-lille.fr	
Laboratoire	IEMN	Web : https://carbon.iemn.univ-lille1.fr/	
Equipe	Carbon	Web :	
	Contrat Doctoral Etablissement	Lille 1 ☐ UVHC ☐ ECL ☐ ISEN-YNCREA ☐	
Financement prévu	Président-Région ☐	Région – Autre ☐ Préciser :	
Acquis ☐	Président- Autre ☐ Préciser	DGA – Autre ☐ Préciser	
	Contrat de recherche ☒ Type ANR	Autre ☐	

Résumé du sujet :

Two-dimensional materials seem well adapted for resistive switching. Indeed, the first non-volatile RF switches incorporating a 2D material of the family of transition metal dichalcogenides (TMDs) begin to appear in literature [Ge18, Kim18]. These devices are non-volatile and particularly promising for high-speed operation, since the R_{ON}*C_{OFF} product scales favorably with the junction area: values below 10fs are expected for sub-micron switches. Despite these promising first realizations, resistive switching remains largely unexplored in TMDs. Only few experimental data are available, and a theoretical understanding of the transport process and of the switching mechanism in the vertical devices is critically lacking.

The first aim of the thesis is to gain a deep understanding of the device working principle. This know-how will be used to develop an optimized non-volatile RF switches and assess the potential for high-frequency applications (above 30 GHz) for 5G and beyond.

The devices will be fabricated in the IEMN state-of-art clean room facilities. The DC and high frequency characterization will be carried out at the IEMN high-frequency characterization facility fully equipped with HF probe stations (0.1 – 110 GHz).

References:

[Ge18] R. Ge *et al.*, « Atomristor : Nonvolatile Resistance switching in atomic Sheets of Transition Metal Dichalcogenides », Nano Letters 18, 2018, 434-441

[Kim18] M. Kim *et al.* « Zero-static power radio-frequency switches based on MoS_2 atomristors », Nature Communications 9, 2018, 2524