



# Diamond MOS capacitor for future diamond transistors

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## LABORATORIES : NEEL, G2ELAB

Diamond has attracted a lot of interest in the last 20 years: it shows the ultimate physical properties which can improve the performances of future power devices in terms of conduction and switching losses. Thus, my thesis dealt with two main objectives :  
i) the fabrication and electrical characterisation of diamond metal-oxide-semiconductor capacitors (MOSCAP) (Fig. 1), one of the building blocks of the future field effect transistors (FETs), and  
ii) the development of a simulation platform to perform TCAD

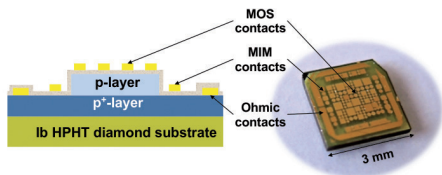


Figure 1 : Schematic cross section (left) of the fabricated diamond MOS capacitor and the corresponding actual device (right).

simulations (Technology Computer Aided Design) in order to anticipate the architecture of the future diamond FETs. In order to gain insight into the properties of the diamond MOSCAP, we performed x-ray photoelectron spectroscopy measurements in collaboration with C. Vallée (LTM-Grenoble). The measurements enabled to establish for the first time the interfacial band diagram alignment of the  $\text{Al}_2\text{O}_3$ /Oxygen-terminated diamond heterostructure.

With N. Rouger (G2Elab, now at LAPLACE, Toulouse) we developed a TCAD simulation platform specific to diamond. It allows us to take into account the unique physical properties of diamond for the design of future diamond power devices.

## OUTCOMES

[1] Energy-band diagram configuration of  $\text{Al}_2\text{O}_3$ /Oxygen-terminated p-diamond metal-oxide-semiconductor, Appl. Phys. Lett. 107, 141601 (2015).

[2] Model implementation towards the prediction of J(V) characteristics in diamond bipolar device simulations, Diamond Relat. Mater., 43, 34, (2014).

[3] Diamond bipolar device simulation, 1st IEEE Workshop on Wide Bandgap Power Devices and Applications (WIPDA) 151 (2013).

**Oral presentations:** ICDCM, Bad Homburg, Germany, 2015. 3rd French-Japanese Workshop on Diamond Power Devices, Nîmes, France, 2015. 2nd French-Japanese Workshop on Diamond Power Devices, Kyushu, Japan, 2014. ICDCM, Madrid, Spain, 2014.

**Patent:** "Procédé de fabrication d'un empilement MOS sur un substrat en diamant" (FR11 62052)

**Award:** PhD Award for A. Marechal, ICDCM Conference, Madrid, 2014.

**Collaborations:** LTM (Grenoble, France) AIST (Tsukuba, Japan), NIMS (Tsukuba, Japan).