Investigating electronics of 2D materials and heterostructures by photoemission electron microscopy

O. Renault
M. Gay, H. Kim, D. Ferrah, M. Frégnaux, M. Jamet*
Univ. Grenoble-Alpes, CEA, LETI, F-38000 Grenoble
** Univ. Grenoble-Alpes, CEA, IRIG/SPINTEC, F-38000 Grenoble*
olivier.renault@cea.fr

Abstract

Photoemission techniques are amongst the most powerful, yet not always easily accessible tools to investigate the electronic properties of 2D materials and related heterostructures. Lab-based instruments providing measurements at the microscopic level are becoming necessary for the optimization of the processing steps of such systems and rapid retrieval of fundamental information such as work function, spin-orbit-splitting, interface charge transfer, band offsets and carriers effective mass. Conventional micro-ARPES, often performed at synchrotron radiation facilities does not bring the necessary lateral resolution and flexibility in terms of access time. In this contribution we will review case studies [1-4] performed with photoelectron emission microscopy, enabling effective investigations at the micron-scale of 2D materials band structure due to the excellent control of the analysis area and minimal radiation damage. Examples will include recently developed Mn-doped $MoSe_2$/graphene systems for spintronic applications.

References

[1] Kim, Chen, Renault, Kis *et al.*, Phys. Rev. B 94 (2016) 081401(R); npj 2D Materials & Applications 2 (2018) 2.
[2] Chen, Kim, Renault, Kis et al., ACS Nano 12 (2018) 11161.
[3] Ferrah, Renault, Bouchiat, Cunget et al., ACS Appl. Nano Mater. 2 (2019) 1356.
[4] Dau, Gay, Renault, Jamet et al., ACS Nano 12 (2018) 2319.

Figures

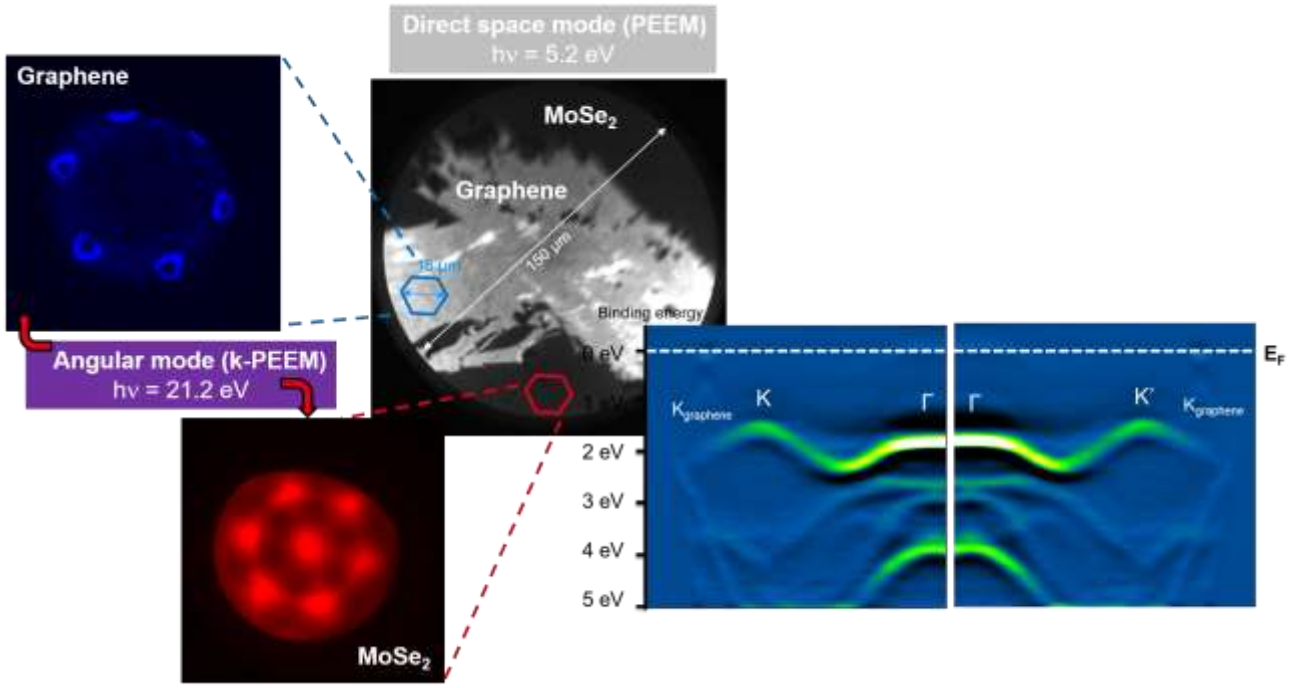

Figure 1: Photoemission electron microscopy (He I excitation) performed over 20µm on a MoSe2/graphene heterostructure.