Fabrication of semi-conducting 2D-materials based devices in a 300 mm pilot line – learnings from the 2D pilot line (2D-PL)

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Abstract

The ambition of the 2D-Pilot line (2D-PL) [1] is to contribute to the enablement of the ecosystem for the integration of 2D materials in the semiconductor industry. Focus for this project is development of integration modules required for the fabrication of photonics, sensors and electronics demonstrators in industrially relevant FAB environments. This work will aid to mature 2D semiconductor technologies and provide information for guiding industrial uptake. This four-year project builds on the foundation of the 2D-Experimental Pilot Line project (2D-EPL) working towards integrated 2D materials in the semiconductor industry.

Additionally, in the project scope, multi-project wafer (MPW) runs are launched both on graphene and semi-conducting 2D materials, allowing access to the pilot line project. These MPW runs [2] allow pilot line costumers the opportunity to test their own devices. Moreover, trainings will be offered to educate on the use the process design kits (PDK).

While in this project, many 2D-PL partners focus on graphene-based devices, imec focusses on the processing of semi-conducting 2D (TMDC) materials in a 300 mm fab environment [3]. We are addressing all the process steps required to deposit the 2D-materials on 300mm wafers by a layer transfer method. The subsequent challenges of encapsulation and further integration are addressed using process choices ensuring Si fab compatibility. Moreover, substantial effort goes into the monitoring of process control, verification of repeatability and wafer level mapping of uniformity. We will guide you through our process findings and also provide electrical device characterisation results.

References

[1] https://graphene-flagship.eu/industrialisation/pilot-line/
[2] https://graphene-flagship.eu/industrialisation/pilot-line/2d-pl-run-1/
[3] T. Schram, S. Sutar, I. Radu, I. Asselberghs, Adv. Mater. 34 (2022) 2109796.