Large scale transfer of 2D materials

Le Van-Jodin Lucie[a]
Nikitskiy Ivan[b], Widiez Julie[a], Okuno Hanko[b], Rieutord François[b]

[a]*Univ. Grenoble Alpes, CEA, LETI, 38000 Grenoble, France*
[b]Univ. Grenoble Alpes, CEA, INAC, 38000 Grenoble, France
luciejodin@yahoo.fr

The last years, a keen interest for 2D materials occurred due to their exceptional properties[1] as high mobility, band gap, flexibility, transparency… Recently the growth processes of 2D materials like graphene or TMDs (transition metal dichalogenide) made a lot of progresses and it is now possible to deposit them on 200mm wafers and more with a good quality[2]. In the same time, a lot of studies have shown the interest of 2D materials in a wide range of domains like microelectronics, optoelectronics, biology, energy[3]… In most applications, 2D materials have to be transferred from the growth substrate to another substrate. Two main ways are used to do this step: by a mechanical exfoliation of the 2D layer or by a wet transfer. In both cases, this step can hardly be realized on a wafer scale and the processes are not well-adapted for an industrialization. Furthermore, this step can create defects like holes, blisters or chemical pollution which are going to affect the properties of the transferred layer[4].
In our project, we propose to develop a process for a large scale transfer. The Smart Cut™ technology is used to do this, several steps are required:

- Deposition of a capping layer to protect the 2D material layer (Figure 1 a-b)
- Implantation of light gas elements under the 2D material layer (Figure 1 c)
- Wafer bonding on the capping which will become the new substrate (Figure d-e)
- Heat treatment during which the donor wafer will split from the 2D layers where elements have been implanted (Figure f)

For this study we are going to focus on the first two steps (Figure 1 a-c) and on their impact on the 2D materials quality. Most of characterizations will be done using Raman spectroscopy but it will be complemented by other ones like electrical measurements, AFM and TEM analysis

References

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Figures

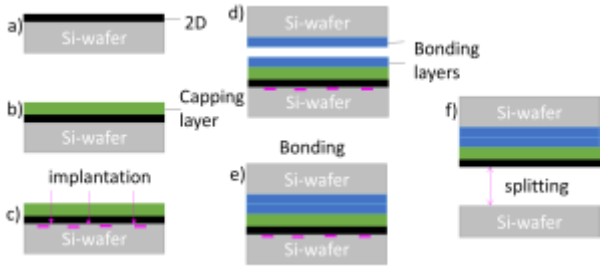

Figure 1: Process flow for graphene transfer