Challenges To Integrate Graphene As Enabling Materials In Smart Systems Fabricated On Flexible Substrates

S.Abbisso[1], S. Di Marco[1], G. Fisichella[2], F.Giannazzo[2], S. Lo Verso[1], V.Vinciguerra[1], S.Ravesi[1]

[1] STMicroelectronics, IPD&AMS R&D, Stradale Primosole 50, 95121 Catania, Italy
[2] CNR-IMM, Strada VIII, 5, 95121 Catania, Italy

The marvelous chemical and physical properties of graphene make it as an ideal candidate to enable the fabrication of new electronic devices and, among those, smart systems fabricated on flexible substrates to be used on IoT and wearable electronics applications [1].

The industrial exploitation of graphene in the microelectronics field demands a, sometime, combined double efforts: to better and deeply understand and control the fundamental properties of the material and to tackle the technological challenges to integrate graphene in a device processing flow, compatible with a fab environment.

In this paper we'll report about our top/down approach, starting with the description of the final application, a sensor node in which some of the subsystem parts will be enabled by the graphene, making an overview of the graphene based components that are and should be available, and going through the main technological challenges that have to be tackled in order to fabricate the demonstrator onto a large area flexible substrate. The transfer of CVD monolayer graphene on plastic substrates has been largely investigated, taking in account three major constraints: to have high quality graphene transferred on a large area (at least 6" wafer size equivalent); to minimize the risk of cross contamination (metal residuals and/or organic solvents) [2]; the presence of steps and morphology related to the previous device architecture. The optimization of processing flow of G-FET as elementary brick of the technological platform will be presented, with focus on the interaction within graphene and the other device materials and on the constraints dictated by the plastic substrate. Sensing elements based on graphene fabricated on large area will be reported.

References

[1] A.C.Ferrari et al., Nanoscale 10 (2014) 1039.
[2] G.Fisichella et al., Applied Physics Letters, 104 (2014) 233105.
[3] This research was supported by European Union Seventh Framework Programme under Grant Agreement No. 604391 Graphene Flagship.