Fabrication of Smart Systems on Flexible Substrates Enabled by Graphene Integration

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Abstract

The marvelous chemical and physical properties of graphene make it as an ideal candidate to enable the fabrication of new electronic devices, especially in the realm on More than Moore [1]. Among its properties the mechanical and electronics ones could be exploited for the development of integrated smart systems on flexible substrates to be used on IoT and wearable electronics applications.

In the framework of EC funded Graphene Flagship, together with our partners, we have demonstrated the feasibility of a sensor node in which many of the system functions can benefit from the graphene use [2]. Graphene based sensors have been developed, and graphene based material has been used for antennas, for communication and energy harvesting, and batteries for energy storage, while the high level functions, signal processing and radio chip, have been delegated to standard Si based technology.

This hybrid approach, mixed graphene and Si based technologies, has been adopted at lower level also for manufacturing approach for the graphene components, and different techniques have been adopted: printing, lithography, graphene ink, CVD graphene and so on.

In this paper we'll focus on wafer scale processing of graphene based components in a CMOS 6" fab environment, 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; to minimize the risk of cross contamination (metal residuals and/or organic solvents) [3]; 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 between graphene and the other device materials and on the constraints dictated by the plastic substrate.

References

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[3] G.Fisichella et al., Applied Physics Letters, 104 (2014) 233105.