**Electronic transport properties of epitaxial graphene on silicon substrates**

Francesca Iacopi

Faculty of Engineering and IT, University of Technology Sydney,

Ultimo 2007 New South Wales, Australia

ARC Centre of Excellence in Future Low-Energy Electronic Technologies

Email: francesca.iacopi@uts.edu.au

Epitaxial graphene on bulk silicon carbide wafers has made extraordinary progress since the pioneering work by Berger and De Heer [1]. However, obtaining EG from silicon carbide on silicon over large areas has proven to be substantially more challenging [2]. Epitaxial graphene on 3C-SiC on silicon wafers would provide considerable benefits, ensuring a seamless integration with silicon technology, and enabling additional fabrication advantages like a site-selective, wafer –scale synthesis [3]. Promising applications range from integrated electronics, photonics, on-chip energy storage to MEMS -based and electrochemical (bio)sensors.

Over the years, the scientific community has focused on translating the successful thermal decomposition route of bulk SiC into a parallel approach onto 3C-SiC on silicon. As a result, among others, of the limitation arising from the highly defective hetero-epitaxial SiC surface, and other reliability issues [4, 5], no reliable evaluation of the transport properties of EG on 3C-SiC on silicon had been possible so far. Here we show how we have overcome those limitations via a liquid –phase, solid source epitaxy approach to achieve larger –scale and consistent graphene coverage even on a highly -defective 3C-SiC surface [6]. We demonstrate similar conductivities as for EG on bulk SiC, and that the transport properties are similarly dominated by a strong substrate interaction. We will discuss advantages, which include a high adhesion to the substrate and the ability to coat any complex 3C-SiC surface [7], as well as current limitations and future perspectives.

**References**:

[1] C.Berger et al, Science, May 26; 312(5777):1191-6, 2006.

[2] Growing graphene on semiconductors, ed. Motta, Iacopi and Coletti, PanStanford Publishing, ISBN 9789814774215, Aug.2017.

[3] B.V.Cunning, M.Ahmed, N.Mishra, A.R.Kermany, B.Wood, F.Iacopi, Nanotechnology 25, 325301, 2014.

[4] A.Pradeepkumar, N.Mishra, A.R.Kermany, J.J.Boeckl, J.Hellerstedt, M.S.Fuhrer, F.Iacopi, Applied Physics Letters 109, 011604 and 196102, 2016.

[5] A.Pradeepkumar, M. Zielinski, M. Bosi, G. Verzellesi, D. K. Gaskill, F. Iacopi, Journal of Applied Physics 123, 215103, 2018.

[6] N. Mishra, J.J. Boeckl, A. Tadich, R.T. Jones, P.J. Pigram, M. Edmonds, M.S. Fuhrer, B.M. Nichols, and F. Iacopi, J. Phys. D: Appl. Phys.50, 095302, 2017.

[7] N.Mishra, M.Bosi, F.Rossi, G.Salviati, J.Boeckl, F.Iacopi, Journal of Applied Physics 126, 065304, 2019.