PO-RV-Th-09

Ullmann coupling reaction on unconventional substrates

M. Abadía[1], A. Gargía Lekue[2], I.Piquero-Zulaica[1], J. Lobo-Checa[3], J. E. Ortega[1], J. Brede[1] and C. Rogero[1,2]

[1]Centro de Física de Materiales CFM – MPC (CSIC-UPV/EHU), E-20018 San Sebastián, Spain; [2]Donostia International Physics Center, E-20018 San Sebastián, Spain; [3]Instituto de Ciencia de Materiales de Aragon (ICMA), CSIC-Universidad de Zaragoza, 50009 Zaragoza, Spain*

celia.rogero@csic.es

In the early 1900's Fritz Ullmann first reported the synthesis of biaryls from aryl halides mediated by a fine copper powder[1], demonstrating with this the aromatic nucleophilic substitution mediated by copper, now known as Ullmann condensation reaction. More than hundred years after, this reaction is routinely used in numerous industrial applications and, nowadays it becomes widely used for the synthesis on metal surfaces of atomically precise graphene nanoribbons[2]

The next step to move toward device applications requires performing the synthesis directly on suitable substrates such as semiconducting, insulating or magnetic substrates. Whit in this context, in the present work we explore the Ullmann based synthesis of polymers on magnetic and insulating substrates. In particular we demonstrate the aryl homocoupling synthesis of 4,4-Dibromo (or diiodo)-p-terphenyl precursor into molecular poly-p-phenylene wires on the semiconductor TiO2 surface3 and on the bimetallic (and ferromagnetic) GdAu2 surface alloy4 . Moreover, we propose a reaction pathway during the polymerization. To monitor the chemical reaction complementary microscopic and spectroscopic surface science techniques (, scanning tunneling microscopy, X-ray photoemission spectroscopy, angle-resolved Photoemission spectroscopy) are used.

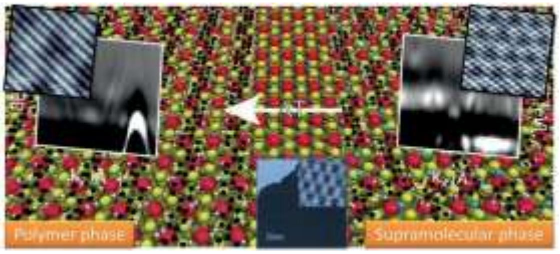

Figure 1 – STM and ARPES experimental observations of Ullmann based Polymer synthesis on GdAu$_2$ alloy

References

[1] Ullmann, F. et al. Berichte der deutschen chemischen Gesellschaft, 34, 2174 (1901); 36, 2382 (1903); 37, 853 (1904).

[2] Grill, L. et al. Nature Nanotech. 2, 687 (2007); Cai, J.; et al. Nature 466, 470 (2010); Talirz, L.; et al. Adv. Mater., 28, 6222 (2016)

[3] Vasseur, G.; et al. J. Am. Chem. Soc. 138, 5685 (2016)

[4] Abadía, M. et al. ACS Nano 11, 12392 (2017)