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On-surface bottom-up synthesis of azine derivatives displaying strong acceptor behavior

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Organic heterostructures based on acceptor-donor molecules on surfaces have become strategic materials due to their huge technological impact in fields such as organic light-emitting diodes (OLEDs), organic field effect transistors (OFETs), or solar cell devices, amongst others. In particular, the charge transfer process promoted by donor/acceptor molecules at the interface with metal electrodes may induce a realignment of the energy levels that can be exploited to tune the transport properties of the system [1].

In the present work, we use on-surface chemistry to synthesize a strong electron acceptor organic molecule directly on a Cu(110) surface [2]. By a thermal annealing process, p-aminophenol (p-Ap) molecules deposited on Cu(110) undergo an azine-coupling reaction. Both, the chemical reaction mechanism and the charge transfer process induced by the substrate were followed by complementary surface techniques (nc-AFM/STM, XPS, NEXAFS and LEED) as well as by theoretical calculations (Fig.1). We observe that Cu(110) catalyzes a chemical reaction between two p-Ap molecules giving rise to a quinoneazine (QAz) molecule. The resulting molecule accepts 1.2e- from the substrate, which brings on a charge redistribution with recovering aromaticity, leading to an azo compound behavior.

[1] R. Otero, A. L. Vázquez de Parga, J. M. Gallego, Surf. Sci. Rep. 2017, 72, 105–145.

[2] N. Ruiz del Arbol, I. Palacio, G. Otero-Irurueta, J. I. Martínez, P. de Andrés, O.Stetsovych, M. Moro, P. Mutombo, M. Svec, P. Jelinek, L. Floreano, G. J. Ellis, M. F. López, J.A. Martín-Gago. Andgewvante chimie, in press.

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