Elucidating the physics of transport through single molecules is a challenging quest that needs approaches complementing the usual transport measurements with normal metal electrodes. We investigated electronic transport through diatomic molecules attached to superconducting electrodes using the break-junction technique (see Figure) at low temperatures. As was recently demonstrated in atomic-size contacts, the richness of electronic transport in the superconducting state [1] allows to make evident the direct relation between the number of conduction channels through a single atom and its chemical valence [2]. Experiments on different diatomic molecules reveal the conduction channels through the metal-molecule-metal structure and allow a quantitative comparison with theoretical calculations. In particular, depending on the molecule, it is shown that conduction is enhanced or decreased.

References:


Figures:

(a) SEM colorized picture. A metallic bridge with dimensions \( \sim 100 \) nm is fabricated on an insulating elastic substrate, using conventional e-beam technique. (b) & (c) Using a bending mechanism consisting of 2 side counter-supports and a centred pushing rod, the bridge is elongated until it breaks. (d) The distance between the resulting electrodes is controlled at atomic scale, allowing to connect a single molecule.