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Identifying individual chemical bonds in single-molecule chemical reaction products using nc-AFM SEBASTIAN WICKENBURG, UC Berkeley, Physics; LBNL, DIMAS G. DE OTEYZA, CSIC/UPV-EHU, San Sebastian, YEN-CHIA CHEN, UC Berkeley, Physics; LBNL, ALEXANDER RISS, HSIN-ZON TSAI, ZAHRA PEDRAMRAZI, AARON J. BRADLEY, UC Berkeley, Physics, MIGUEL M. UGEDA, UC Berkeley, Physics; LBNL, PATRICK GORMAN, GRISHA ETKIN, UC Berkeley, Chemistry, DUNCAN J. MOWBRAY, ALEJANDRO PEREZ, ANGEL RUBIO, NanoBio and ETSF, UPV/EHU, San Sebastian, MICHAEL F. CROMMIE, UC Berkeley, Physics; LBNL, FELIX R. FISCHER, UC Berkeley, Chemistry; LBNL — Determining reaction pathways and products is an integral part of chemical synthesis. Ensemble measurements are commonly used, but identifying products of complex reactions at surfaces presents a significant challenge. Here we present a non-contact AFM (nc-AFM) study to directly address this issue[1]. We followed the change of the chemical structures, from reactants to products of enediyne cyclization reactions on metal surfaces. Thermal annealing of enediynes induced a series of cyclization cascades leading to radical species and the formation of dimers. Atomically resolved nc-AFM images reveal the precise chemical structure and the formation of chemical bonds between single molecular units. With the support of DFT calculations, we identified the underlying chemical pathways and barriers, demonstrating the potential of this atomically resolved AFM technique to study unknown reaction products in surface chemistry at the single-molecule level.
[1] D. G. de Oteyza et al., Science 340, 1434 (2013)

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