

Supplementary Information (STM videos)

Video 1 High-resolution *in situ* STM video sequence showing fluctuations at the tip of a needle-like Bi island on Au(111) at -0.19 V. The video was recorded at 10 Hz, but is converted to display at real time.

Video 2 High-resolution *in situ* STM video sequence showing kink propagation along the edge of a needle-like Bi island on Au(111) at -0.40 V. The video was recorded at 10 Hz, but is converted to display at real time.