Molecular mechanical memory based on fractal Sierpiński triangles

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Building memories with single molecules holds great promise for high-density data storage applications. A key challenge in this field is achieving stable, rewritable memory with reliable read/write capabilities. In this work, we construct a one-dimensional periodic structure based on fractal Sierpiński triangles, assembled from 4-[3-(4-cyanophenyl)phenyl]benzonitrile (C3PC) and Fe atoms. Using a qPlus sensor, we demonstrate that the adsorption sites of the molecules can be reversibly switched via metal tip manipulation, while measuring the critical force required for this process. The reversible manipulation of these molecules makes the 1D periodic structure an ideal prototype for molecular memory. To showcase its potential, we encode "PKU" (abbreviation for Peking University) in binary form as a proof of concept.

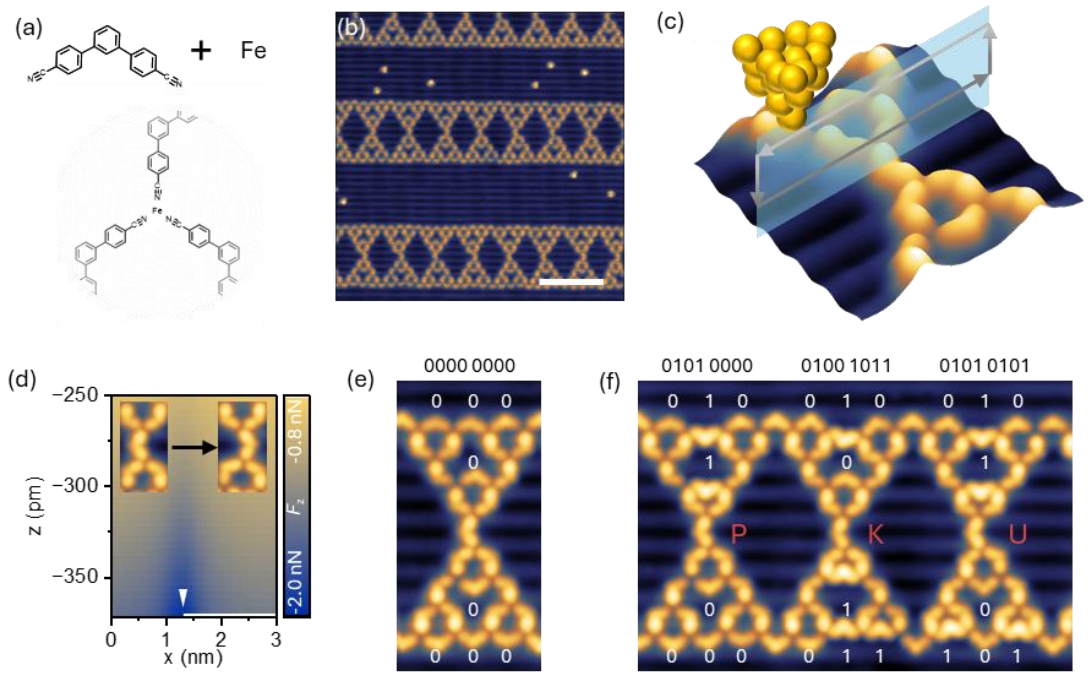

Figure 1. (a) Schematic of coordination structure formed by C3PC and Fe atoms. (b) STM iamge of 1D fractal Sierpiński triangle chains. (c) Schematic of tip manipulation to switch the adsorption site of C3PC. (d) Force line spectrum during the tip manipulation. (e) Definition of information sites in a 1D fractal Sierpiński triangle chain. (f) Binary encoding of PKU demonstrated in the 1D fractal Sierpiński triangle chain.