Supporting Information

High-Dense, Vertically Aligned Crystalline CrO_2 Nanorod Arrays Derived From Chemical Vapor Deposition Assisted by AAO Templates

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Experiment

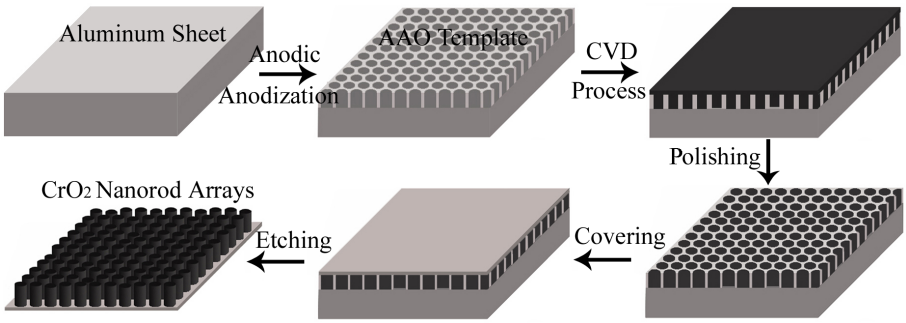

Figure.S1. Schematic of the fabrication of CrO_2 nanorod arrays.

Figure.S1 shows the schematic diagram of the fabrication process of CrO_2 nanorod arrays. AAO templates for CrO_2 deposition were prepared by two-step anodic anodization[1] of aluminum sheet (99.999%) in 0.3 M oxalic acid at a constant voltage of 40 V. Following anodization, the templates were soaked in a phosphoric acid solution (5%) at 30℃ for 30 minutes to enlarge the diameter of the pores. The CVD deposition reactor consists of a quartz tube placed inside a furnace. During the deposition, a 1cm×1cm AAO template was placed vertically in the reaction zone, and CrO_3 (0.5g) was placed in the source zone. The temperature of the AAO template and the precursor was slowly increased to 380 °C and 260°C respectively, and then kept constant. Oxygen was used as carrying gas flowing from the source zone to reaction zone. Sublimed CrO_3 was transported to reaction zone and diffused into the pores of the AAO template where they decomposed into CrO_2 with evolution of O_2. CrO_2 initially grew along the AAO template pores, and finally overflowed on the surface of the AAO template to yield a continuous CrO_2 layer. After deposition, the overflowed CrO_2 surface layer was mechanically polished away using diamond nanoparticles carefully. And CrO_2 nanorod arrays were got in the AAO template. For XRD and magnetic measurements, epoxy resin was coated on the surface of the AAO template, serving as a protecting and holding layer, and the remanent Al metal on the back of the template was etched in a saturated $CuCl_2$ solution. While for SEM observation, the AAO template was further dissolved in 10% NaOH solution, and freestanding CrO_2 nanorods were got on the epoxy resin layer.

TEM Images

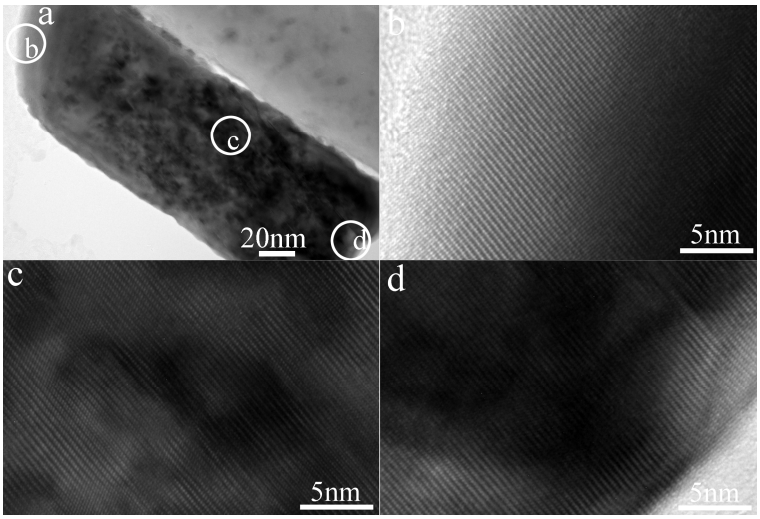

Figure.S2 (a) Low-magnification TEM image of a single CrO_2 nanorod. (b), (c) and (d) HRTEM images marked in (a). These HRTEM images reveal that the nanorod is a single crystal.

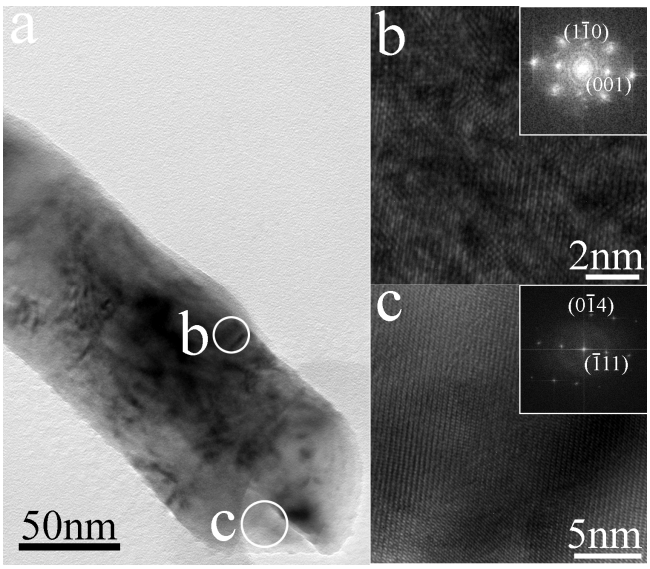

Figure.S3 (a) Low-magnification TEM image of a single CrO_2 nanorod. (b) and (c) Representative HRTEM images marked in (a), insets show the FFT images of the HRTEM images.

Figure.S3 (a) shows a typical TEM image of CrO_2 nanorod which has a rhombohedral Cr_2O_3 crystal on the top. Figure.S3 (b) shows the HRTEM image marked in (a), the two dimensional fast Fourier transform (FFT) of the lattice-resolved image (inset of the Figure.S3 (b)) indexed to a tetragonal CrO_2 lattice. Figure.S3 (c) shows the HRTEM image of the rod top (marked in Figure.S3 (a)), the FFT image indexed to a rhombohedral chromic oxide (Cr_2O_3) lattice.

Reference

1. Hideki Masuda and Kenji Fukuda, *Science.* 1995, **268**, 1466.