

Electronic Supplementary Information

Chiral Nanoscale Pores Created During the Surface Explosion of Tartaric Acid on Cu(111)

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Temperature Programmed Reaction Experimental Methods

All TPR experiments were conducted in ultra-high vacuum (UHV). The Cu(111) sample was prepared by many cycles of Ar⁺ sputtering and annealing and its cleanliness was verified by low energy electron diffraction (LEED). R,R- tartaric acid (Fluka > 99.7% enantiopurity) was deposited from a homemade sublimation source in UHV with great detail to assure uniform surface coverage. The diameter of the source was on the order of the diameter of the Cu(111) substrate, which was positioned about 100 mm away from the front aperture of the source, to minimize a radial concentration gradient in tartaric acid deposition. The functionality of the source and placement of the substrate was verified by experiments

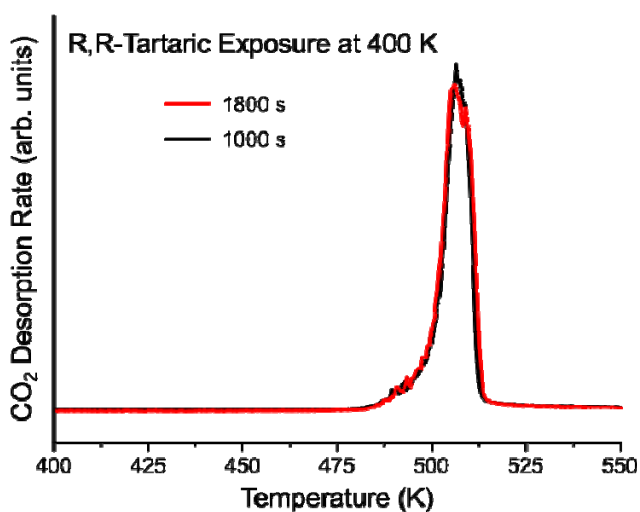


Fig. S1. Two TPR traces monitoring the desorption of CO₂ at different tartaric acid exposure times, providing evidence of surface saturation.

with a Cu(110) crystal, as the tartaric acid decomposition kinetics have been well established on Cu(110). Tartaric acid deposition was performed by holding the source at a fixed flux and changing the deposition time. Fig. S1 provides evidence that tartaric acid surface saturation (1.0 ML) was achieved; when the deposition time was nearly doubled the CO₂ traces remained overlapping. The 1800 s exposure was used in Fig. 1 of the main text. Due to the complicated unit cell structures, presence of multiple unit cells at one time, and the three equivalent arrangements of each on the Cu(111) surface, the LEED was not useful in identifying surface structures.

Scanning Tunneling Microscopy Experimental Methods

All STM imaging was performed at room temperature using an UHV variable temperature scanning tunneling microscope (VT-STM, Omicron Nanotechnology). The Cu(111) was prepared by many cycles of Ar⁺ sputtering (1.5 keV, 15 μ A) and annealing at 750 K. R,R- tartaric acid was deposited onto a room temperature sample from a homemade sublimation source in a preparation chamber ($P < 1 \times 10^{-9}$ mbar). A monolayer of tartaric acid was formed by depositing excess tartaric acid onto Cu(111) at room temperature. The sample was then transferred under UHV to the STM chamber ($P < 1 \times 10^{-10}$ mbar) where anneals were carried out in the STM stage using a pyrolitic boron nitride (PBN) heater embedded behind the sample. Careful annealing to temperatures between 300 and 500 K (± 1 K of desired set point,

~1 K/s ramp rate) for specific lengths of time (± 1 s) were possible with this setup. The as-prepared sample was flash annealed to 405 K to desorb multilayers, and then heated to 455 K for different lengths of time and cooled back to room temperature for STM imaging. Data was recorded with Veeco and Omicron etched W and 85:15 Pt-Ir tips.

Proposed hydrogen bonded network for hexagonal structure

The proposed model for the (10,7; -7,3) structure is made up of monotartrate species oriented upright. Depicted on the left of the figure are a side and a top-down view of the molecule. The top-down view is used to construct the hydrogen bonded model shown on the right, overlaid with the red dots which represent the individual molecules as shown in Fig. 3 of the main text. The black parallelogram represents the unit cell. Hydrogen bonding is represented by the dashed lines in the model. Trimers of monotartrate species are hydrogen bonded together cyclically by the carboxylic acid groups, whereas adjacent trimer units are held together by the outward dangling alcohol groups. The molecules can orient in a way to form linear hydrogen bonds, both between carboxylic acids and alcohols. In regards to the alcohol interaction, each trimer unit is linked to another primarily through a linear hydrogen bond, but it also appears that secondary long-range hydrogen bonding can occur represented by the more spaced dotted lines. It should be noted that the direction of the cyclic hydrogen bonding (i.e. clockwise or counterclockwise) cannot be determined from STM for the carboxylic acids or alcohols, this model only represents one possibility.

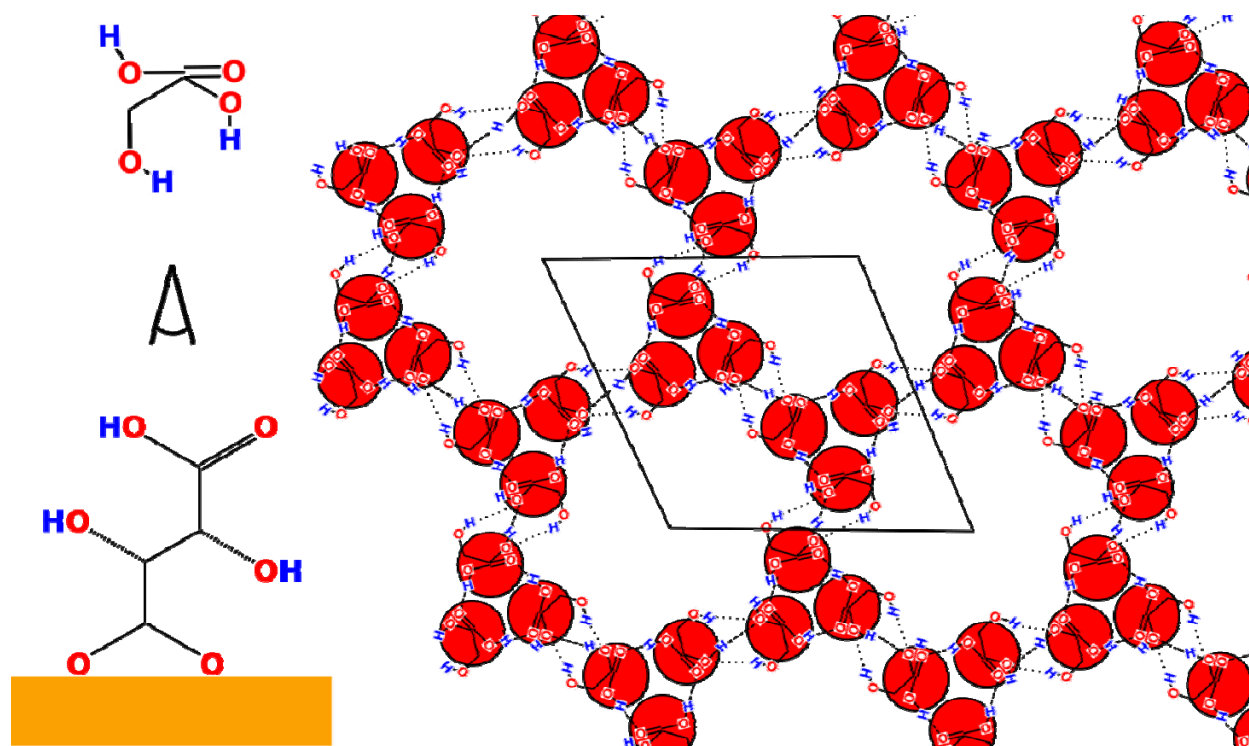


Fig. S2. Proposed hydrogen bonding model of tartaric acid in the for the (10,7; -7,3) structure.