University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

ADVANCED ELECTRONIC MATERIALS

Supporting Information

for *Adv. Electron. Mater.*, DOI: 10.1002/aelm.201901264

Ferroelectric Behavior in Exfoliated 2D Aurivillius Oxide Flakes of Sub-Unit Cell Thickness

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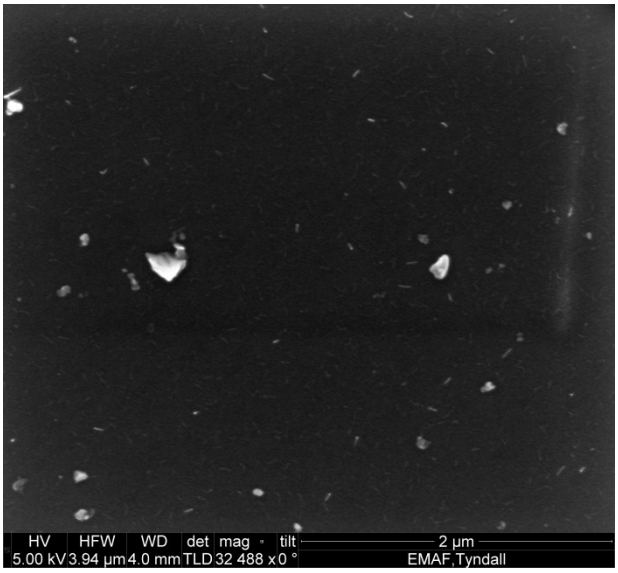

Figure S1. Supporting Information: Representative top-view HRSEM image of exfoliated B5TFCO flakes.

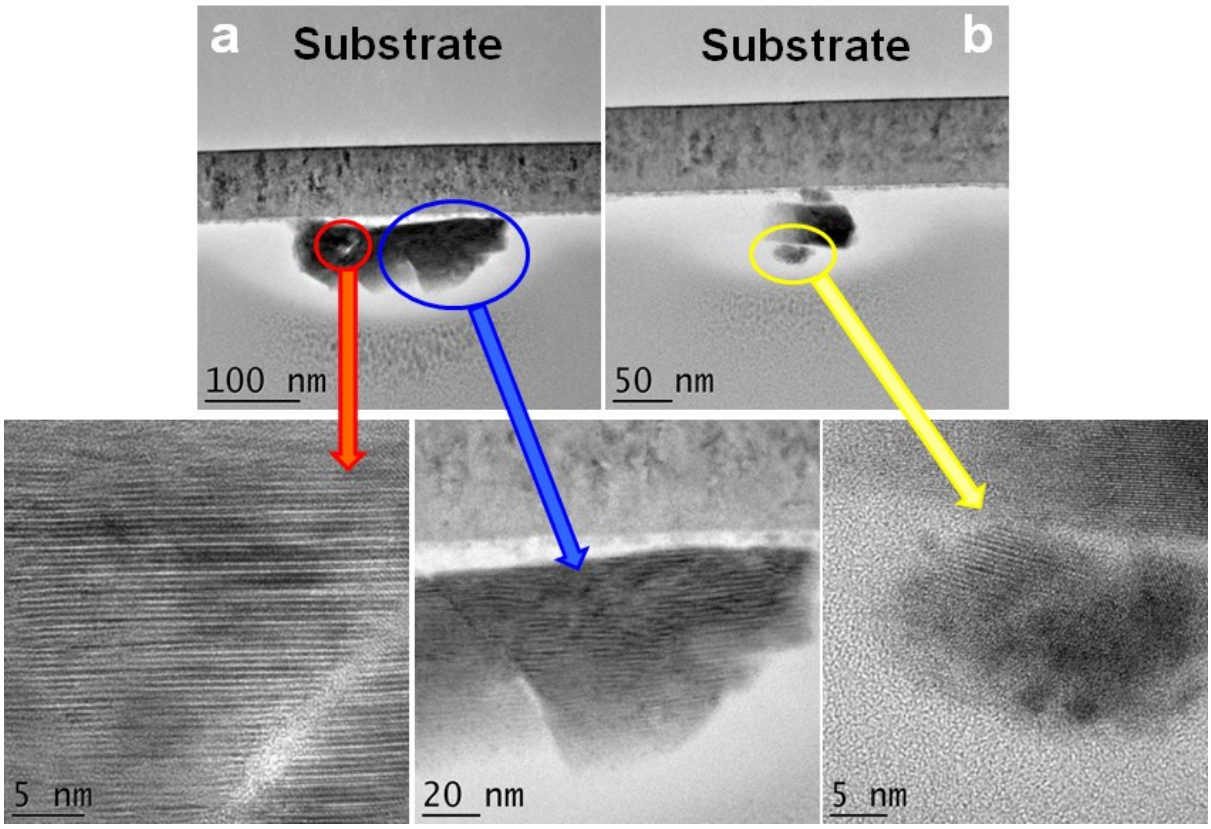

Figure S2. Cross-sectional TEM images of exfoliated B5TFCO flakes. HRTEM of a larger horizontal cluster of multi-flakes (maximum thickness of 80nm and diameter of 230nm) **a** and HRTEM of a smaller vertical multi-flake stack (maximum thickness of 65nm and diameter of 80nm) **b**.

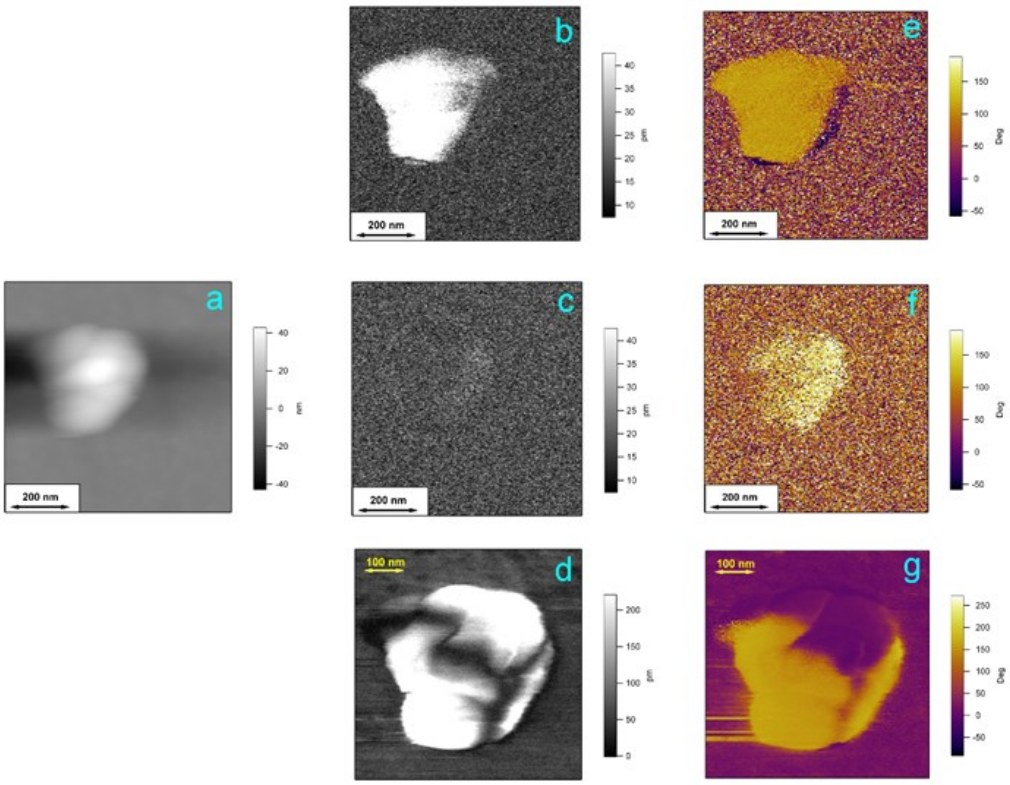

Figure S3. Representative **a.** topography, **b.** lateral single frequency PFM amplitude, **e.** lateral single frequency PFM phase, **c.** vertical single frequency PFM amplitude and **f.** vertical single frequency PFM phase **d.** vertical DART-PFM amplitude and **g.** vertical DART-PFM phase images of a multi-flake cluster of exfoliated B5TFCO.

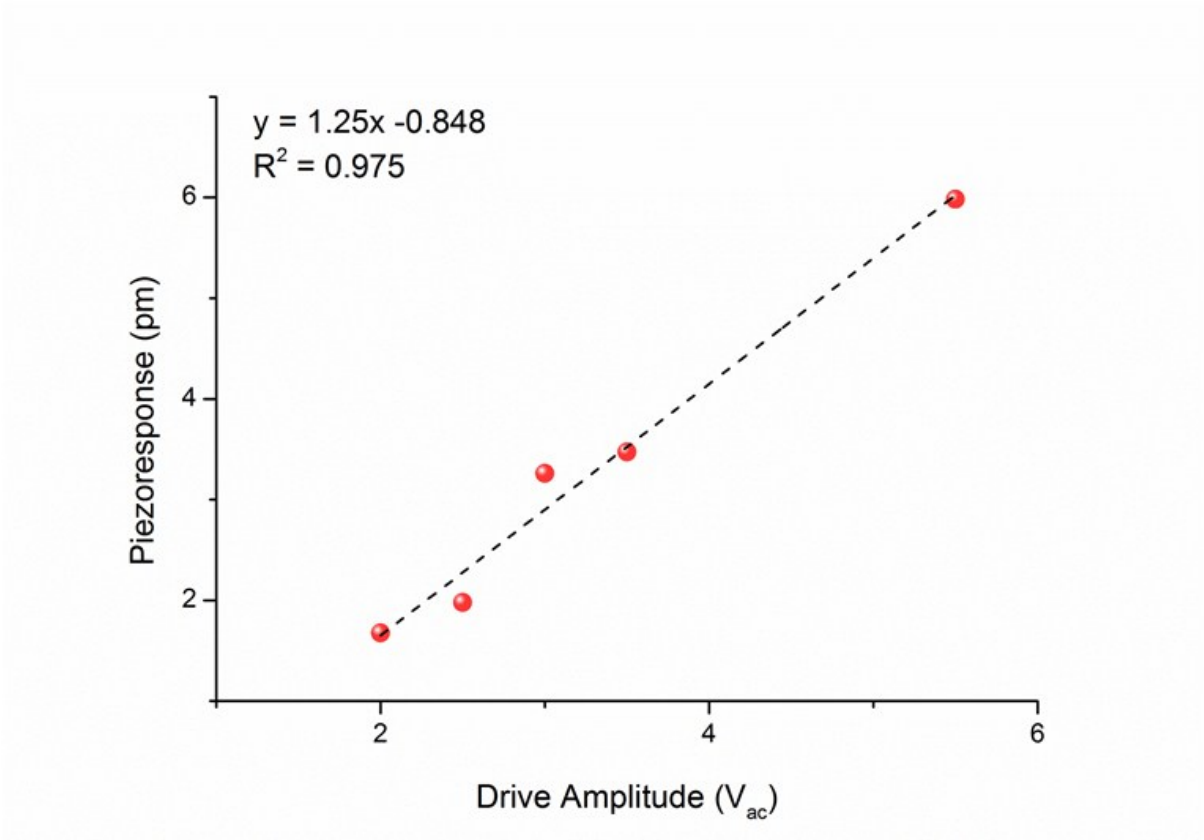

Figure S4. Piezoresponse as measured by vertical DART-PFM switching spectroscopy as a function of drive voltage (2.0 to 5.5V) at a constant DC bias of 15V. Note that the piezoresponse has not been normalized to pmV^{-1}, it has been displayed in picometers (pm) to allow for the change in piezoresponse as a function of voltage to be demonstrated.

PFM Response Modelling

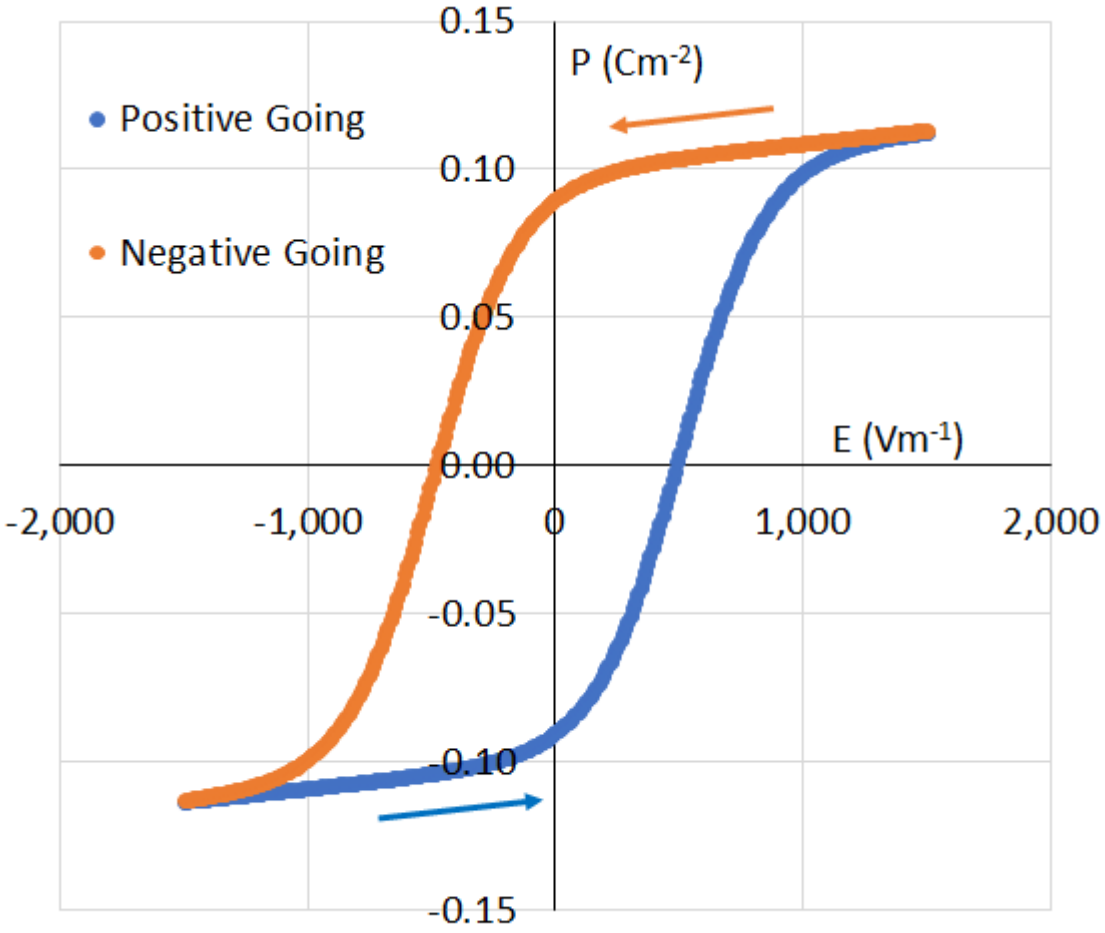

Figure S5. Model of ferroelectric hysteresis based on the function shown in Equation (S18) and (S19).

(P_S=0.1Cm^{-2}, P_R=0.09Cm^{-2}, E_c=500Vm^{-1}, ε_{opt} =2).