Supplementary information

A transparent room-temperature ferromagnetic semiconductor on glass: anatase Co-doped TiO_2 oriented thin films with improved electrical conduction

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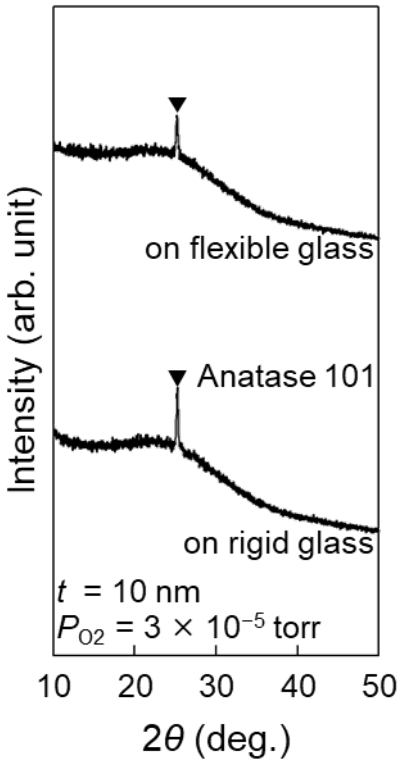

Fig. S1. X-ray diffraction θ–2θ patterns for $Ti_{0.95}Co_{0.05}O_{2-\delta}$ thin films grown at 450 °C and 5 × 10^{-7} Torr of O_2 partial pressure on rigid and flexible glass substrates with 10 nm-thick TiO_2 buffer layers.

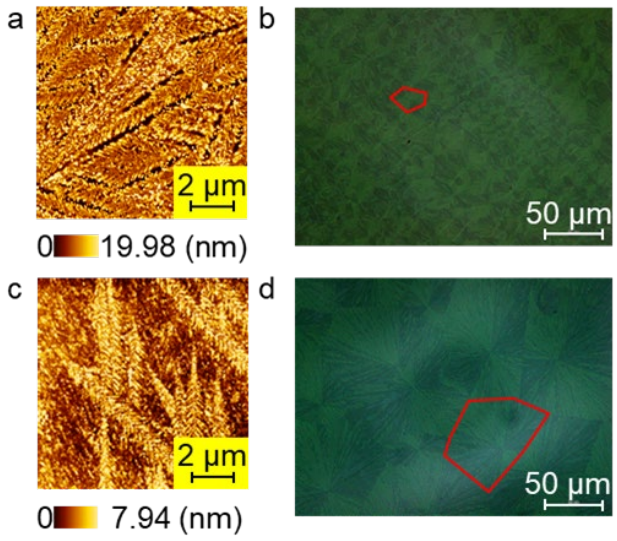

Fig. S2. (a, c) Atomic force microscope images and (b, d) polarized optical microscope images for $Ti_{0.95}Co_{0.05}O_{2-\delta}$ thin films grown at 450 °C and O_2 partial pressure of 5 × 10^{-7} Torr with 10 nm-thick TiO_2 seed layer on (a, b) rigid and (c, d) flexible glass substrates. A crystal domain is highlighted by red polygon in (b) and (d).

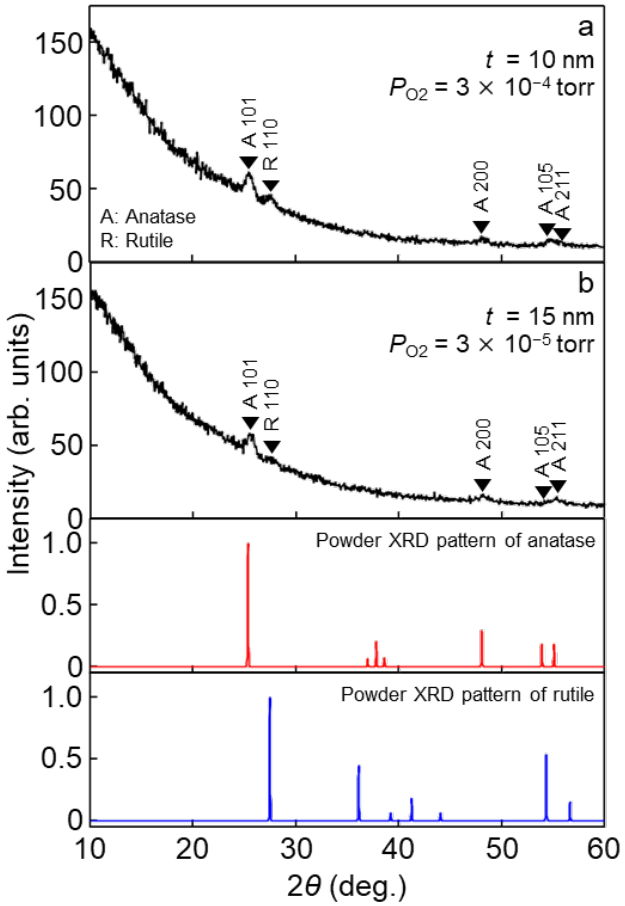

Fig. S3. Grazing incidence X-ray diffraction patterns measured with incident angle of 0.3° for $Ti_{0.95}Co_{0.05}O_{2-\delta}$ thin films on TiO_2 seed layers deposited (a) at oxygen partial pressure of 3.0×10^{-4} Torr and (b) with thickness of 15 nm on rigid glass substrate. Powder X-ray diffraction patterns of anatase and rutile TiO_2 are also presented as references.[S1,S2]

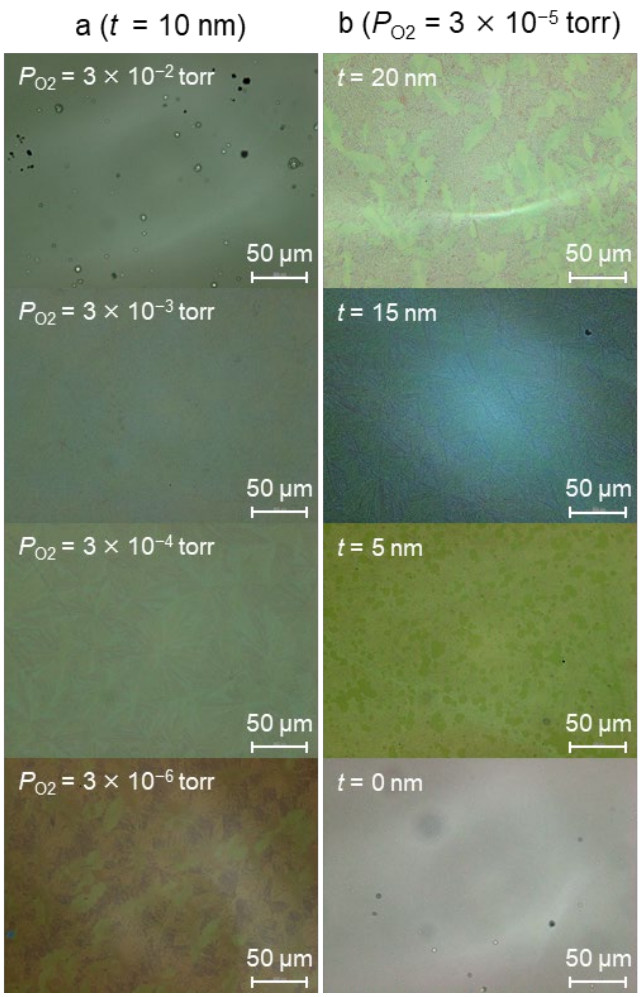

Fig. S4. Polarized optical microscope images for $Ti_{0.95}Co_{0.05}O_{2-\delta}$ thin films on (a) 10 nm-thick TiO_2 seed layers deposited at various P_{O2} on rigid glass substrates, and (b) TiO_2 seed layers with various thicknesses deposited at P_{O2} of 3 × 10^{-5} Torr on rigid glass substrates.

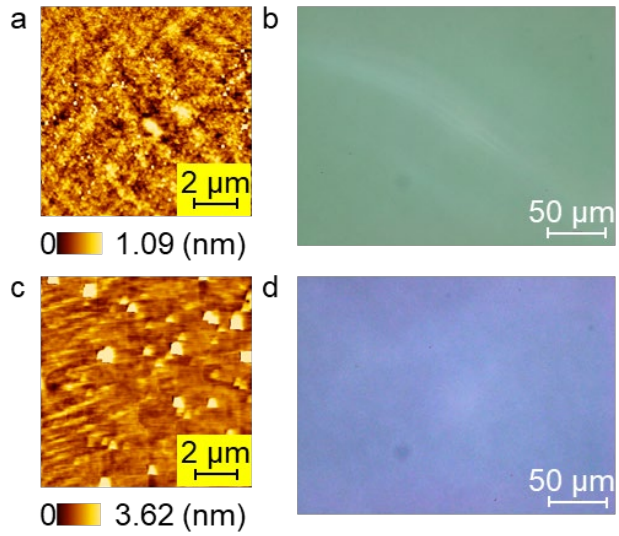

Fig. S5. (a, c) Atomic force microscope images and (b, d) polarized optical microscope images for 10 nm-thick TiO_2 seed layers grown at O_2 partial pressure of 3×10^{-5} Torr, followed by *in-situ* annealing at 600 °C for 60 minutes, on (a, b) rigid and (c, d) flexible glass substrates.

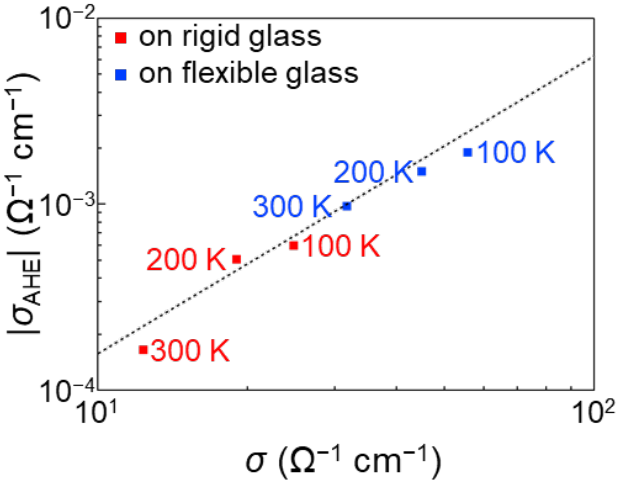

Fig. S6. Scaling relationship between electrical conductivity σ and saturated anomalous Hall conductivity $|\sigma_{AHE}|$ for $Ti_{0.95}Co_{0.05}O_{2-\delta}$ thin films on rigid and flexible glass substrates at 100 K, 200 K and 300 K.

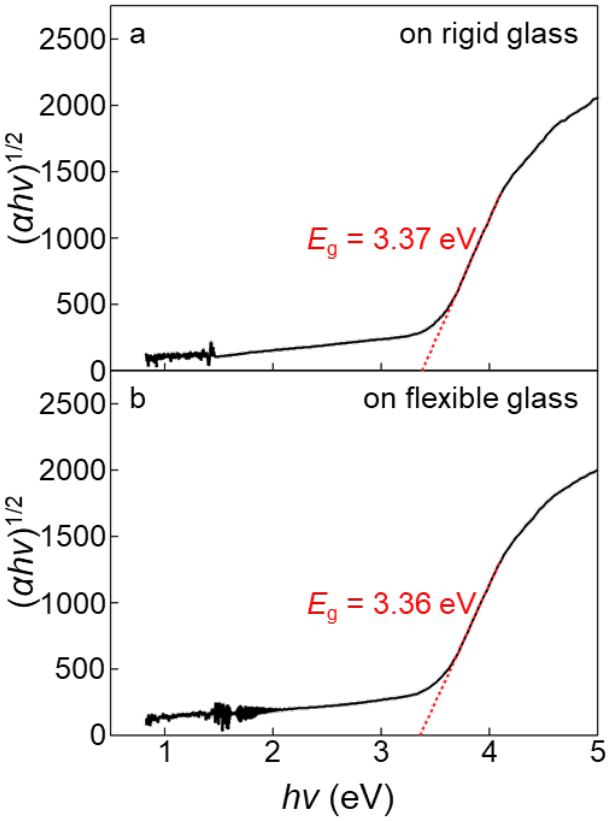

Fig. S7. Tauc plots to determine the bandgaps E_g for $Ti_{0.95}Co_{0.05}O_{2-\delta}$ thin films on (a) rigid and (b) flexible glass substrates.

References

S1. M. Horn, C. F. Schwerdtfeger and E. P. Meagher, *Z. für Krist.*, 1972, **136**, 273.

S2. W. H. Baur and A. A. Khan, *Acta Cryst*., 1971, **B27**, 2133.