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Investigation of the mechanism of the anomalous Hall effects in $Cr_2Te_3/(BiSb)_2(TeSe)_3$ heterostructure

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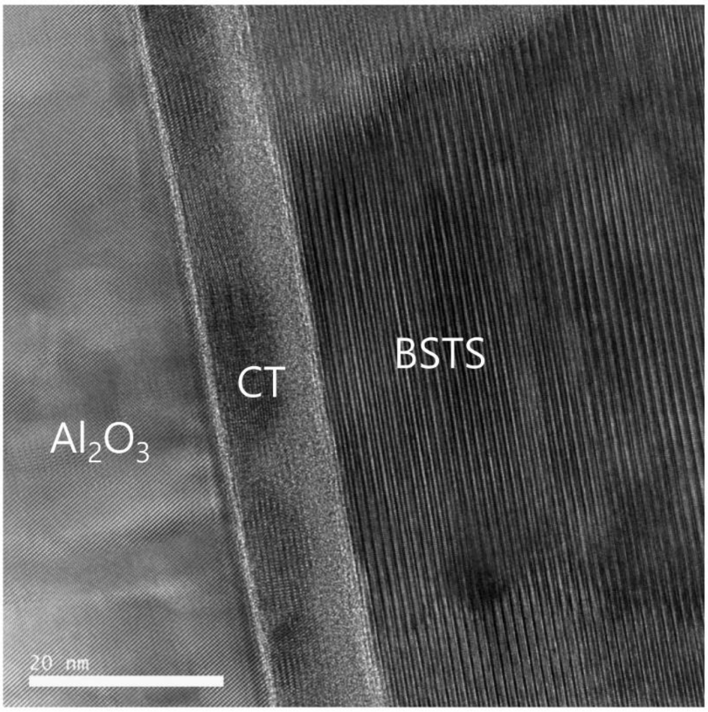

Fig. S1. TEM cross-sectional image of CT / BSTS heterostructure.

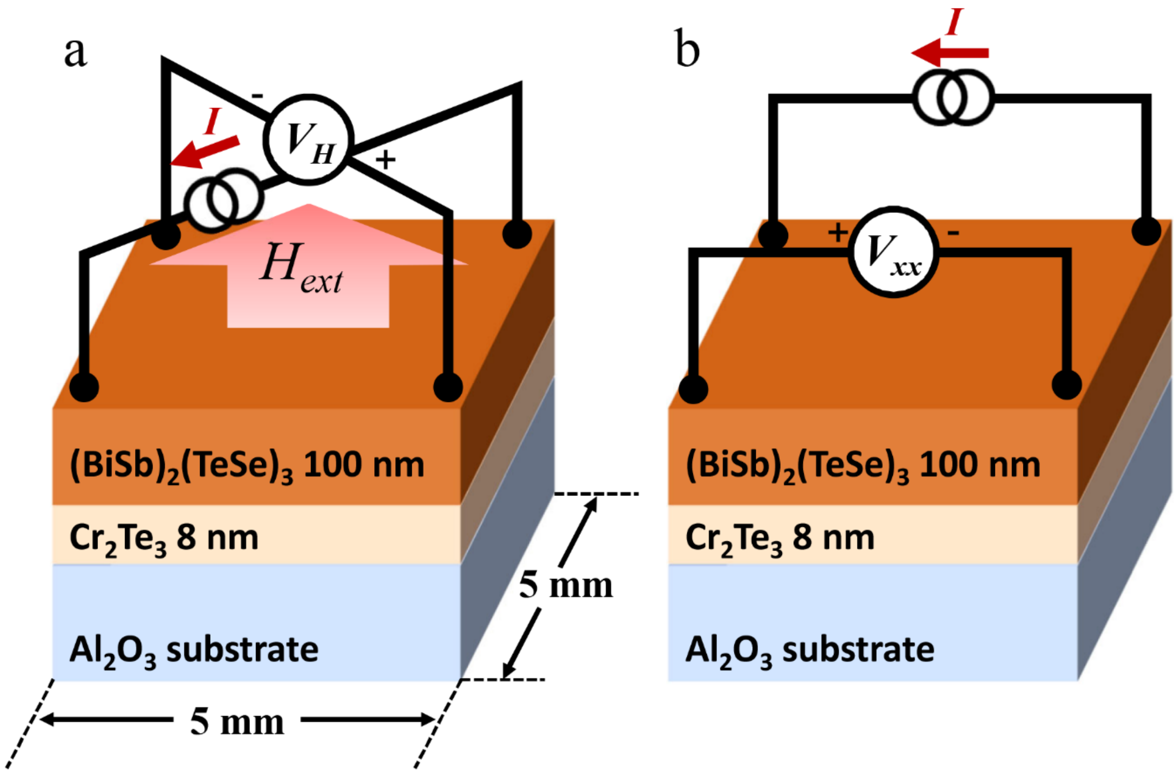

Fig. S2. Schematic illustration of the CT / BSTS heterostructure and the measurement setup. The Hall (a) and longitudinal resistance (b) are measured using the conventional Van der Pauw (VdP) method with samples of 5 mm × 5 mm square.

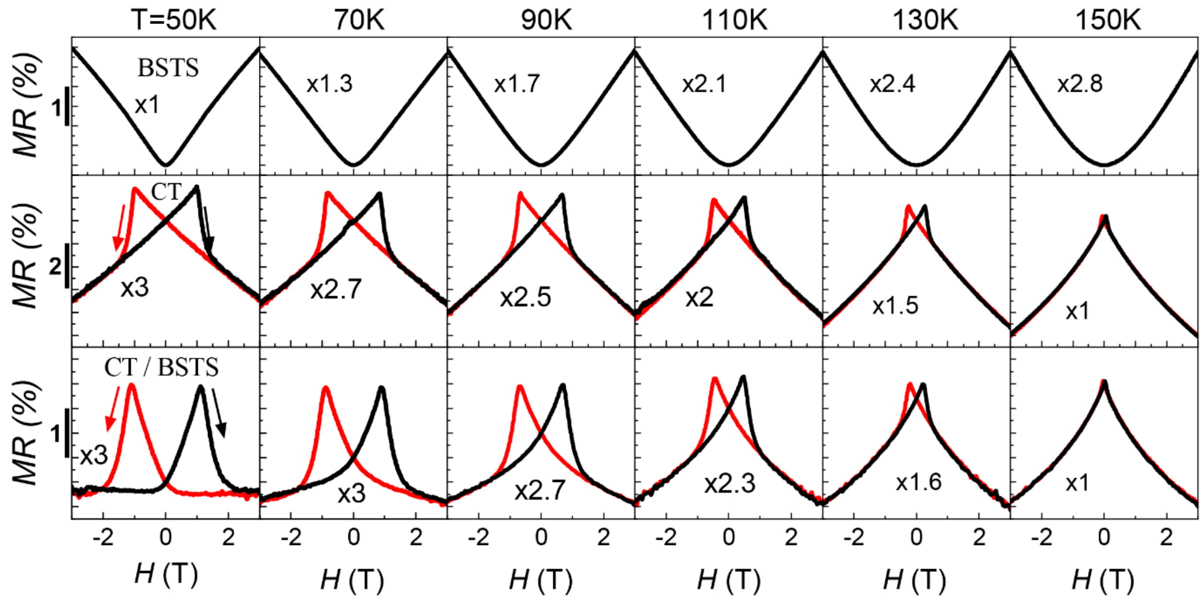

Fig. S3. The magnetoresistance vs. magnetic field curves of BSTS, CT, and CT/BSTS heterostructure. The measurement temperature is indicated at the top of the panel. The black and red curves represent the cases for the ascending and descending magnetic fields, respectively.

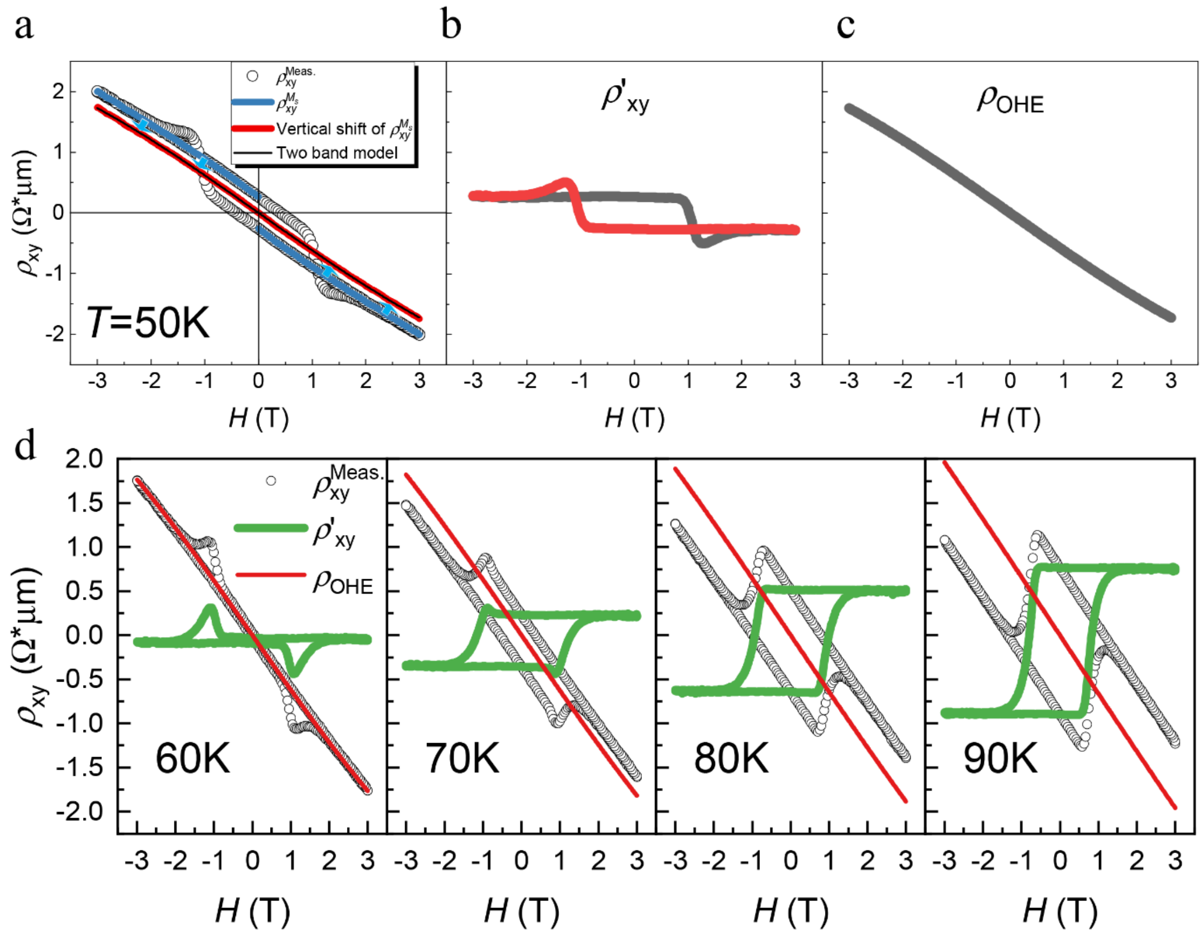

Fig. S4. Process of decomposing the Hall resistivity. The process of decomposing the Hall resistivity at 50K is represented in a, and the process is summarized as follows:

Step 1> Extract $\rho_{xy}^{M_s}$ from $\rho_{\mathrm{xy}}^{\mathrm{meas.}}$ where the magnetization is saturated and far enough away from the coercive field (blue line).

Step 2> Add an offset so that the extracted $\rho_{xy}^{M_s}$ crosses the origin (red line).

Step 3> The red line obtained through the above process represents the ordinary Hall effect. Fit this curve through the two-band model which expresses the nonlinear ordinary Hall effect (black line).

Step 4> The reduced Hall resistivity ($\rho'_{\mathrm{xy}} = \rho_{\mathrm{AHE}} + \rho_{\mathrm{hump}}$) is extracted by subtracting the ordinary Hall resistivity (ρ_{OHE}) from $\rho_{\mathrm{xy}}^{\mathrm{meas.}}$.

The extracted ρ'_{xy} and ρ_{OHE} from the above process are shown in b and c, respectively. The decomposition results of $\rho_{xy}^{meas.}$ at 60-90K are shown in d.

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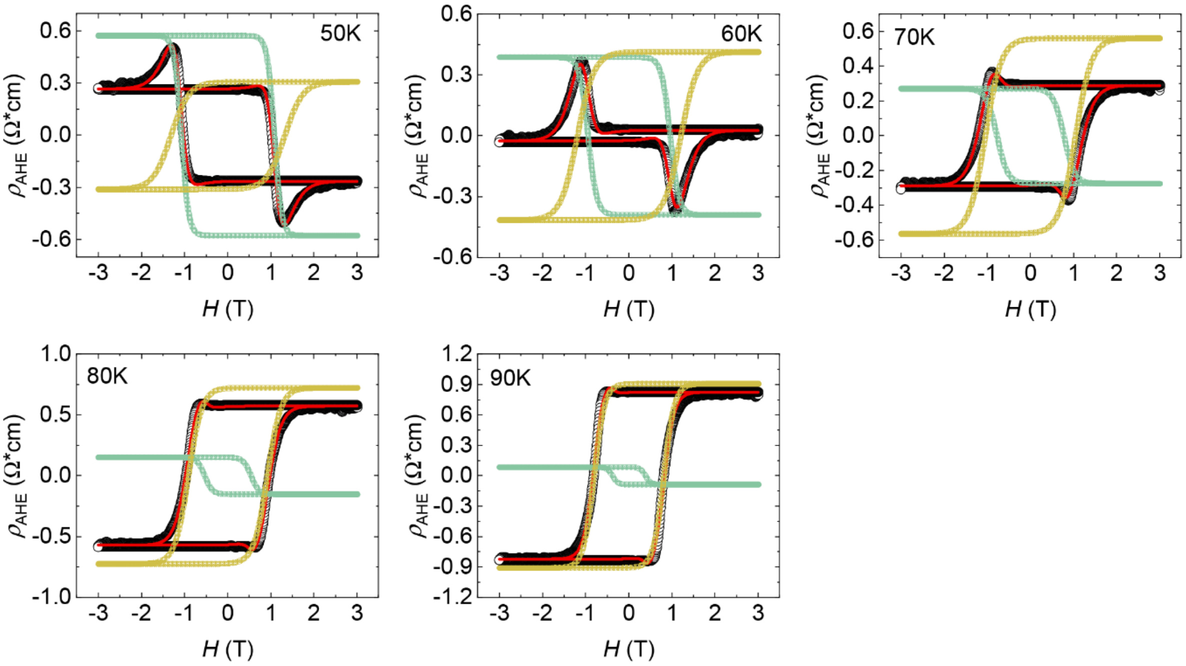

Fig. S5. Separation of two AHE components by the mathematical fitting. The black open circle indicates the raw data. The yellow and green lines represent the component giving the positive and negative AHE, respectively. The red curve is the sum of those two components.