Electronic Supplementary Material (ESI) for Chemical Communications

Synthesis and Magnetic Properties of Cr_2Te_3 and $CuCr_2Te_4$ Nanocrystals

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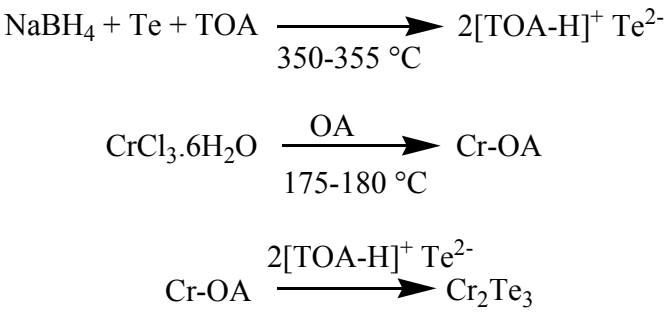
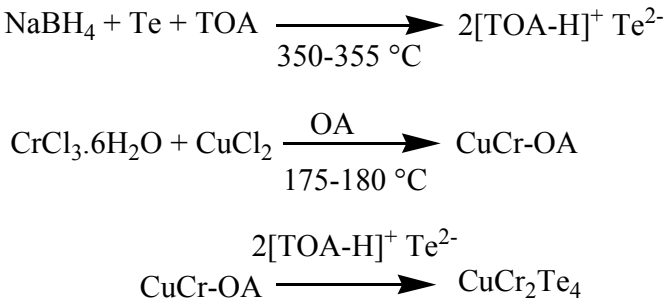


Scheme S1



Scheme S2

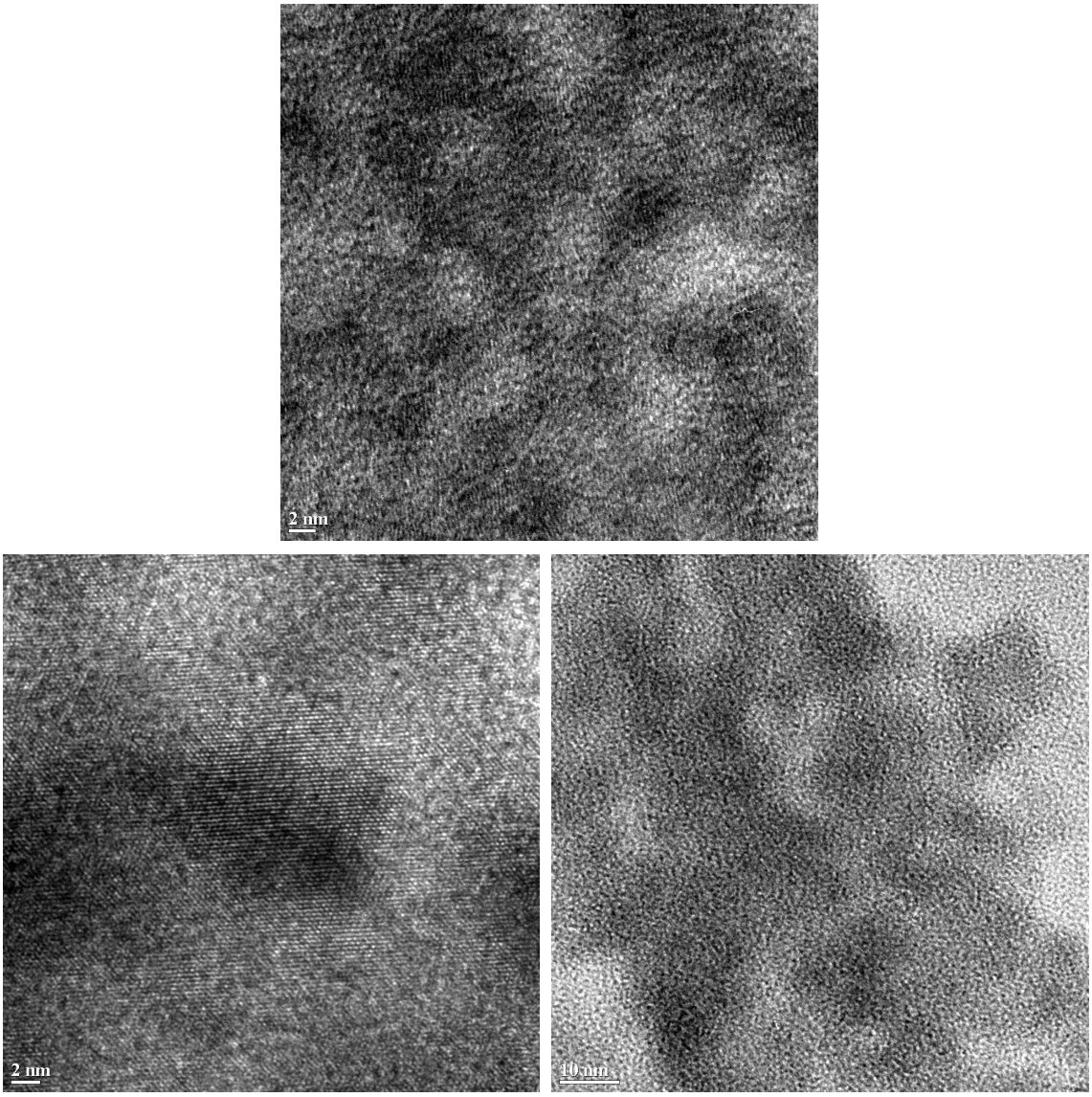


Fig S1. Transmission electron microscope (TEM) images of Cr_2Te_3 nanocrystals synthesized at 350-355 °C.

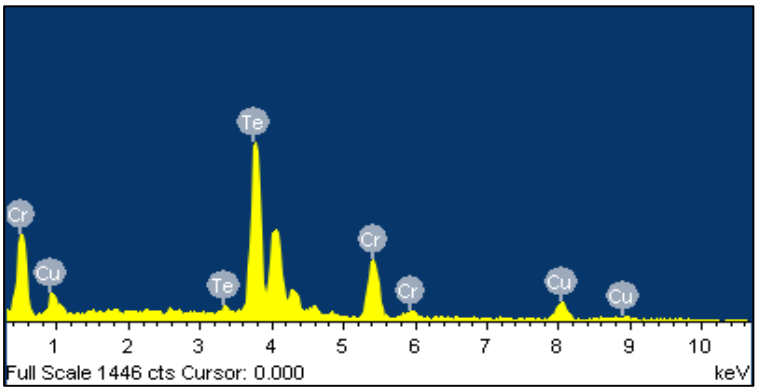


Fig S2. SEM-EDX spectra of $CuCr_2Te_4$ nanocubes.

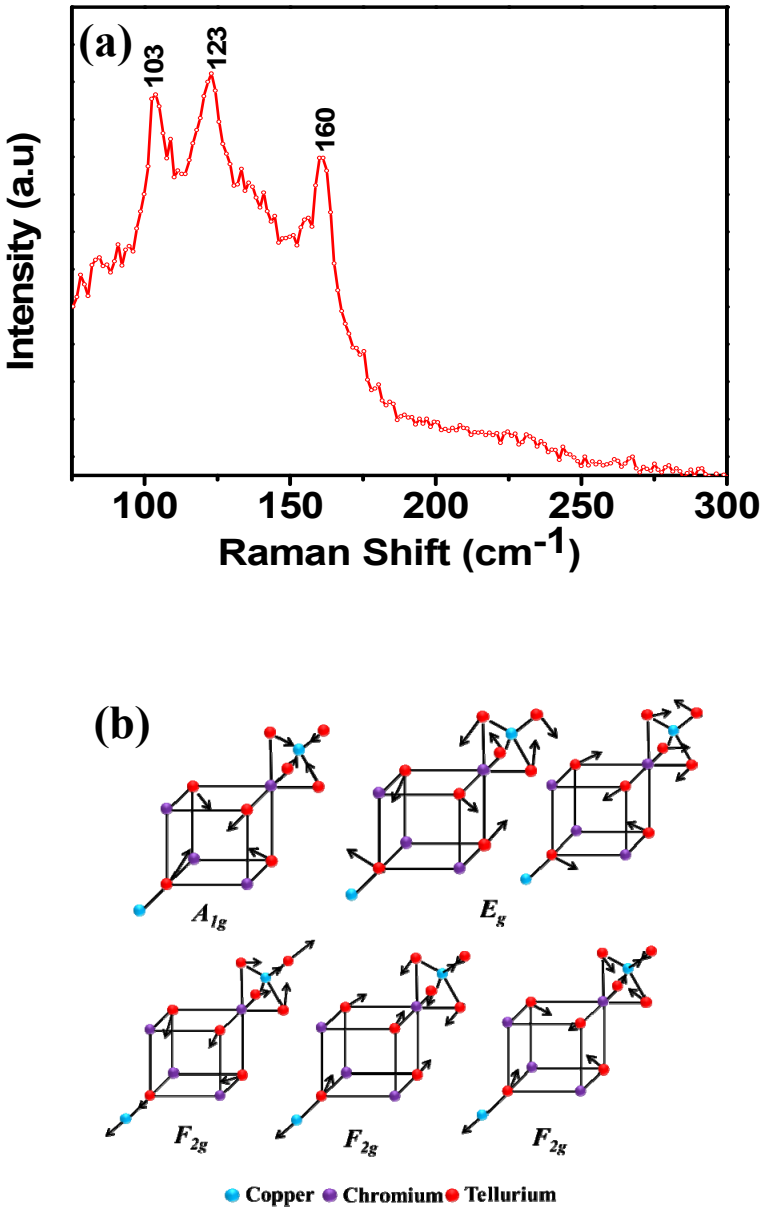


Fig S3. (a) Raman spectra of $CuCr_2Te_4$ nanocrystals with 633 nm (1.99 eV) excitation; (b) Raman modes of $CuCr_2Te_4$ spinel.

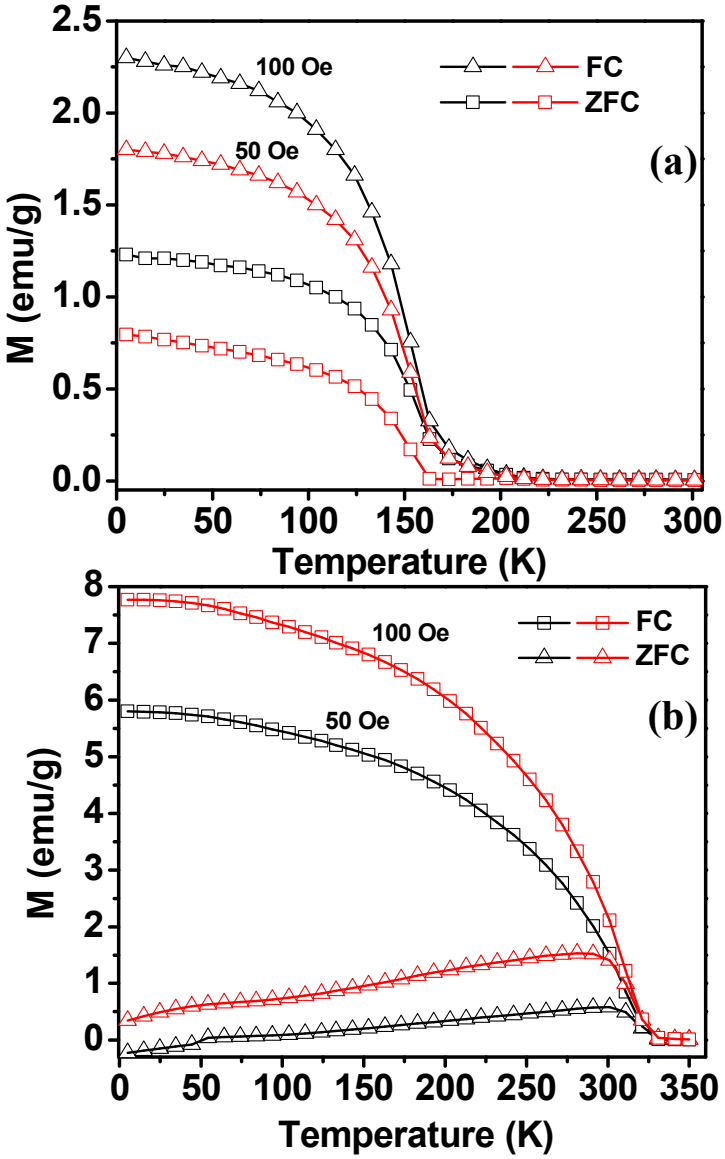


Fig S4. Magnetization (*M*) as a function of temperature for field-cooled (*FC*) and zero-field-cooled (*ZFC*) measurements at 100 Oe and 50 Oe for (a) Cr_2Te_3 and (b) $CuCr_2Te_4$ nanocrystals.

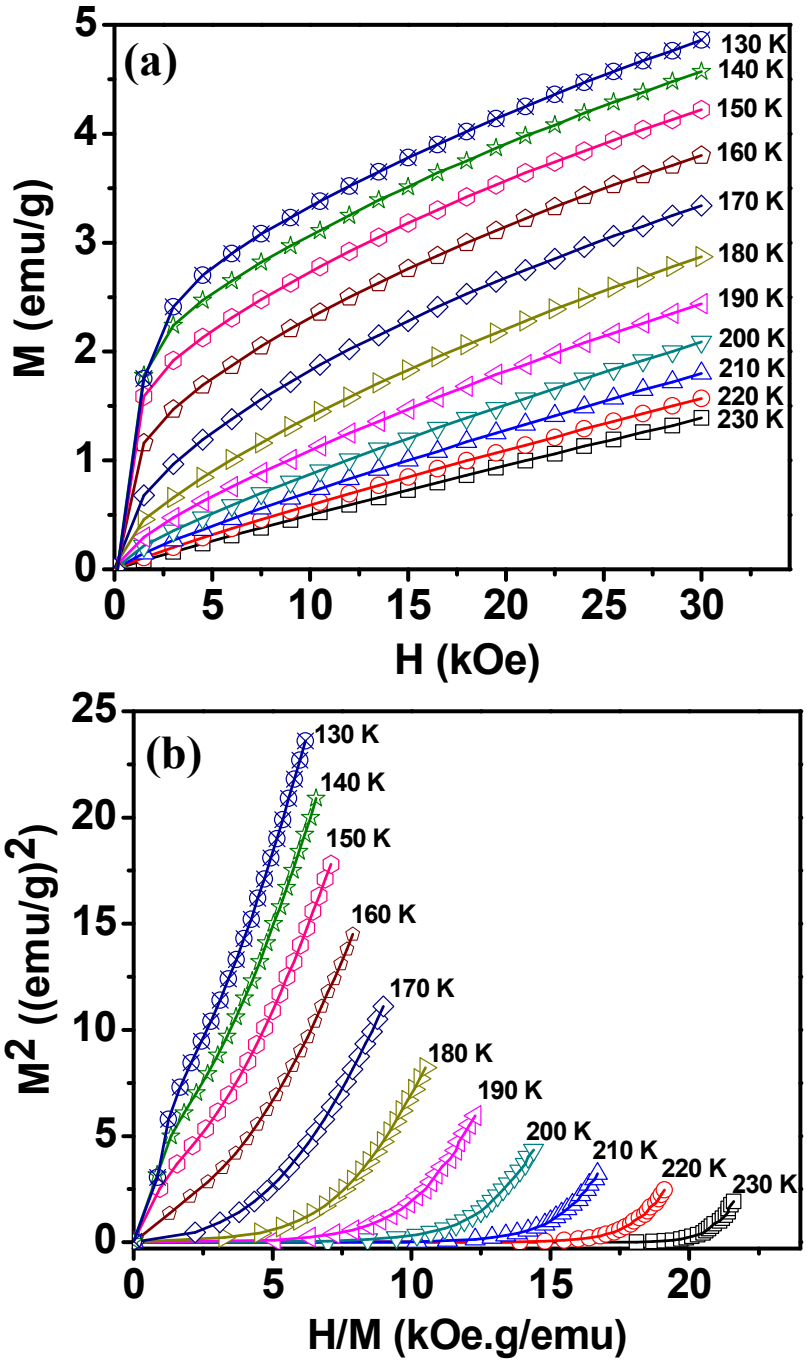


Fig S5. (a) Isothermal magnetization around T_C for Cr_2Te_3 nanocrystals; (b) the Arrott plot (isotherms of M^2 vs. H/M) for Cr_2Te_3 in the temperature range of 130-230 K.

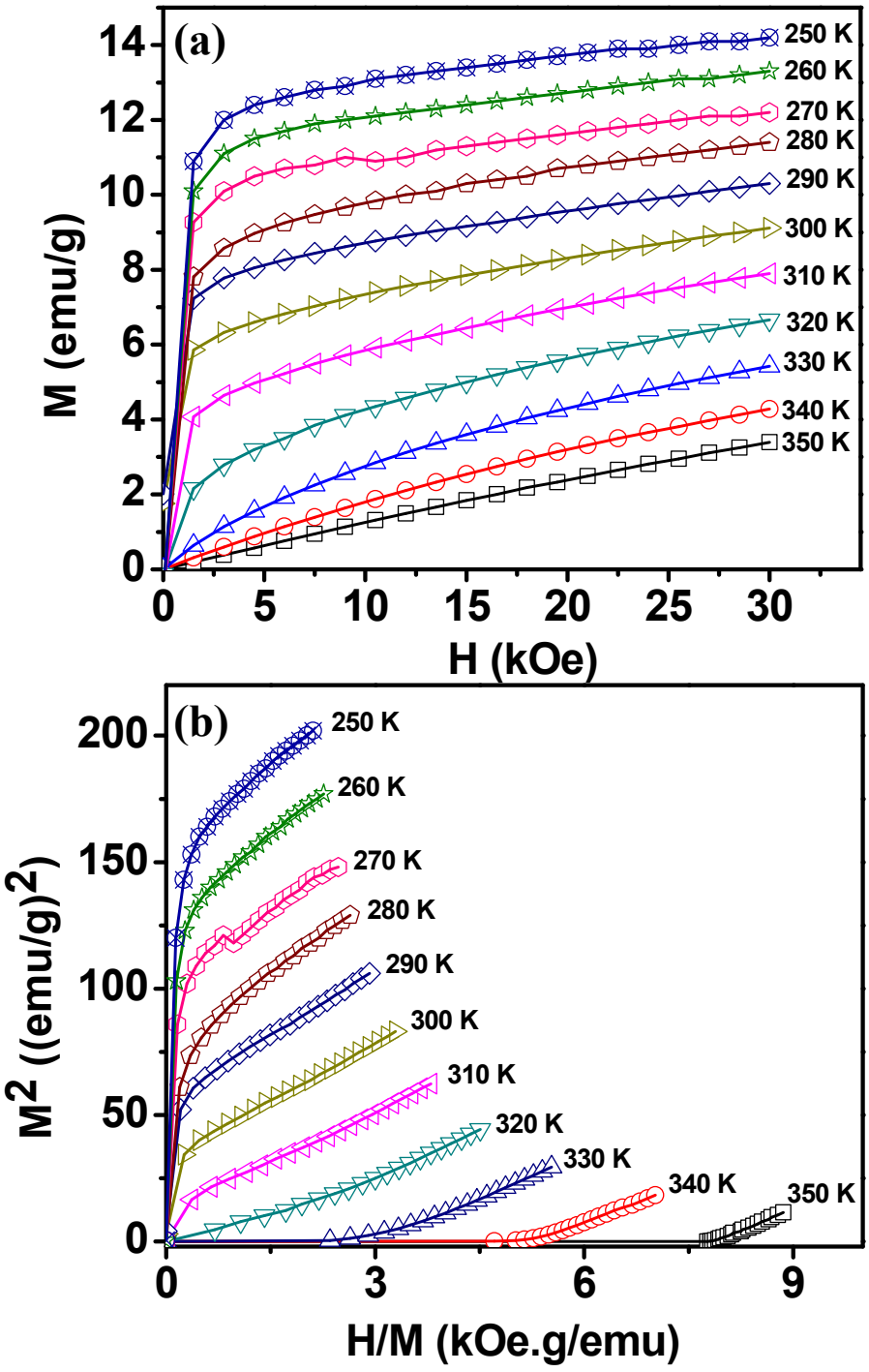


Fig S6. (a) Isothermal magnetization around T_C for $CuCr_2Te_4$ nanocrystals; (b) the Arrott plot (isotherms of M^2 vs. H/M) for $CuCr_2Te_4$ in the temperature range of 250-350 K.

Materials. All chemicals were used as received, and the solvents were dried in molecular sieves and purged with high purity argon for 30 minutes before use. Tellurium powder and chromium chloride ($CrCl_3.6H_2O$, 99.5 %) were received from Alfa Aesar; anhydrous copper chloride ($CuCl_2$, ≥99.0%) and trioctylamine (TOA, ≥99.0%) were obtained from Acros organics; oleylamine (OLA, 70%) was purchased from Aldrich Chemical Co. Analytical grade hexane and ethanol were also obtained from Aldrich.

Synthesis. Standard Schlenk techniques were used for all the experiments in a fume hood under a N_2 atmosphere. For the synthesis of Cr_2Te_3 nanocrystals, 0.4 mmol of Te powder, 0.4 mmol of $NaBH_4$ in 25 mL of TOA (98 %) were degassed at room temperature for 10 min and then backfilled with N_2 for 10 min. The mixture was subsequently heated to 170-180 °C under vacuum and then to 350-355 °C under N_2, and maintained at this temperature for 1h. In another vessel, 0.4 mmol of $CrCl_3.6H_2O$ and 2 mL of oleylamine (OLA) was placed under vacuum for 10 min and then in N_2 atm for 10 min at room temperature. The vessel was heated in stages to 80-90 °C under vacuum and then to 180-190 °C under N_2 (but not exceed 200 °C). The $CrCl_3.6H_2O$ and oleylamine mixture was then rapidly injected into the Te-containing vessel. The vessel was then quickly reheated to the original temperature (350-355 °C), and the resulting mixture continually stirred for 30 min. Following this, the mixture was cooled to 60-70 °C and a 1:3 mixture of hexane and ethanol was added to precipitate the nanocrystals. The black precipitate was then isolated via centrifugation. The washing process was repeated four times to ensure removal of any excess capping agent. A similar procedure was used for the synthesis of $CuCr_2Te_4$ nanocrystals but using excess of tellurium powder (0.8 mmol) and $NaBH_4$ (0.8 mmol), and a mixture of $CuCl_2$ and $CrCl_3.H_2O$ (with 1:2 stoichiometry of Cu:Cr) in oleylamine was

injected into the Te-containing vessel. The experiment reproducibly yielded 70-75 % of Cr_2Te_3 and 40-45 % of $CuCr_2Te_4$ nanocrystals

Measurements. Transmission electron microscopic (TEM) analysis was performed using a FEI-Tecnai, 200 kV transmission electron microscope equipped with a CCD camera for STEM, HAADF detector, and EDX. TEM image non-linear processing carried out using Gatan digital micrograph version 3.4. Powder XRD patterns were recorded on a Bruker D8 instrument equipped with a Cu Kα radiation source operated as a rotating anode at 40 kV and 20 mA. Raman spectroscopy was performed with a Raman spectrometer (Jobin Yvon, HR800 UV), excitation using the 633 nm HeNe line. Scanning electron microscope (SEM) analysis was carried out using a JEOL 7000 FE SEM equipped with EDX, WDS, EBSD, SE, BE and TE detectors. Magnetic measurements were performed using a superconducting quantum interference device (SQUID) with MultiVu application. Crystal structure data were obtained from the Inorganic Crystal Structure Database (ICSD) database.