

Effect of thermal annealing treatment and defect analysis on AgGaGeS₄ single crystal

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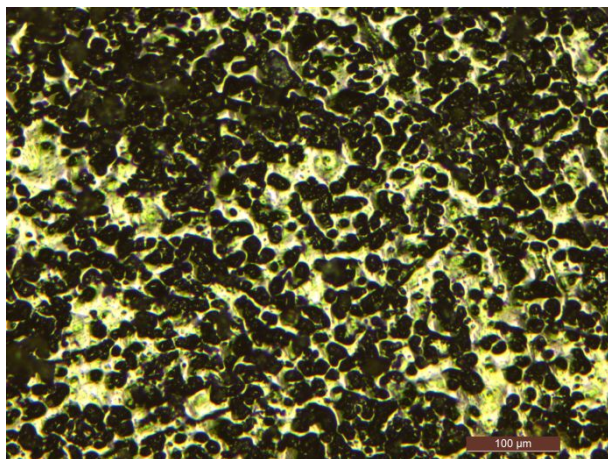


Figure S1. Metallographic microscope photographs of AgGaGeS₄ wafer surface after annealing
with polycrystalline powder at 600 °C

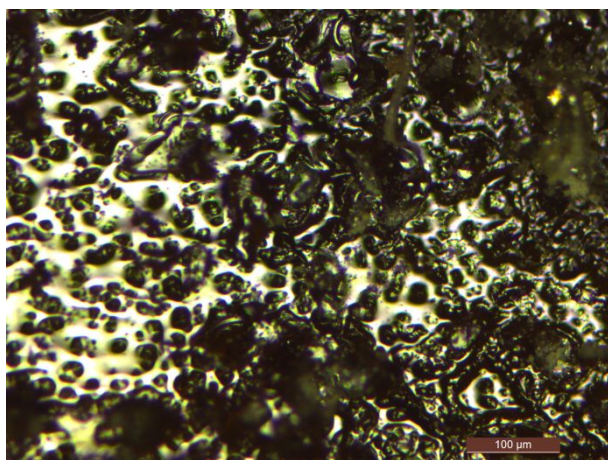


Figure S2. Metallographic microscope photographs of AgGaGeS₄ wafer surface after annealing
with polycrystalline powder at 650 °C

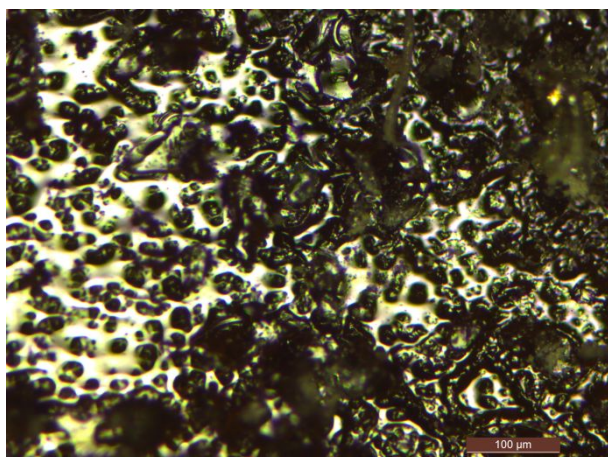


Figure S3. Metallographic microscope photographs of AgGaGeS₄ wafer surface after annealing with polycrystalline powder at 700 °C

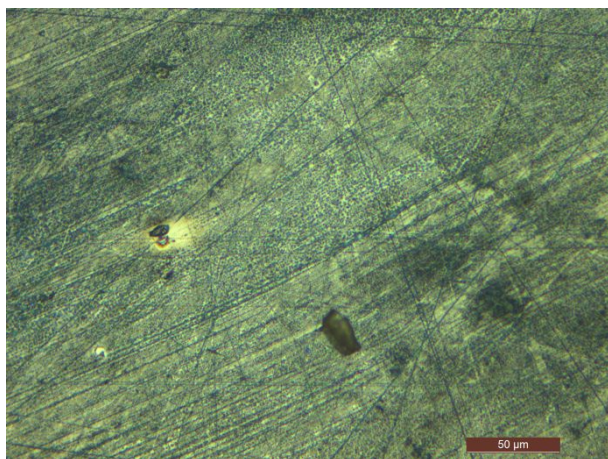


Figure S4. Metallographic microscope photographs of AgGaGeS₄ wafer surface after annealing in vacuum at 500 °C

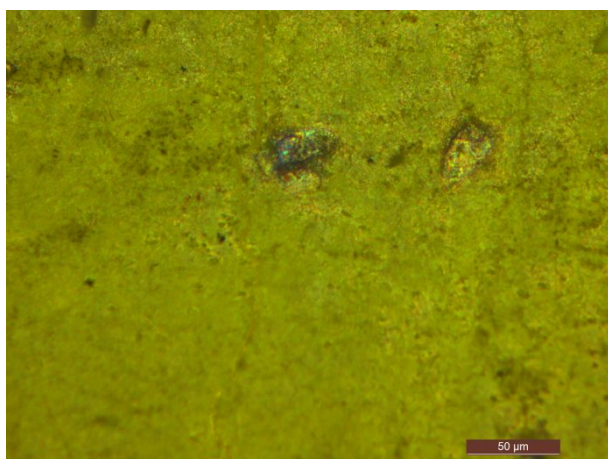


Figure S5. Metallographic microscope photographs of AgGaGeS₄ wafer surface after annealing in vacuum at 600 °C (additional experiment)

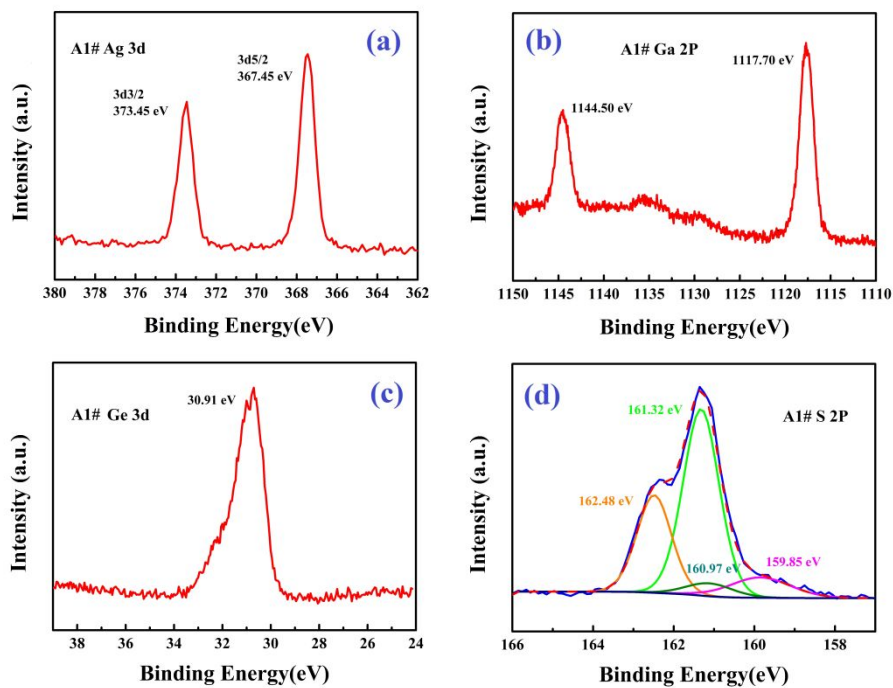


Figure S6. Detailed XPS recorded for polished surfaces of the A1# AgGaGeS₄ single crystals (a) Ag 3d; (b) Ga 2p; (c) Ge 3d; (d) S 2p

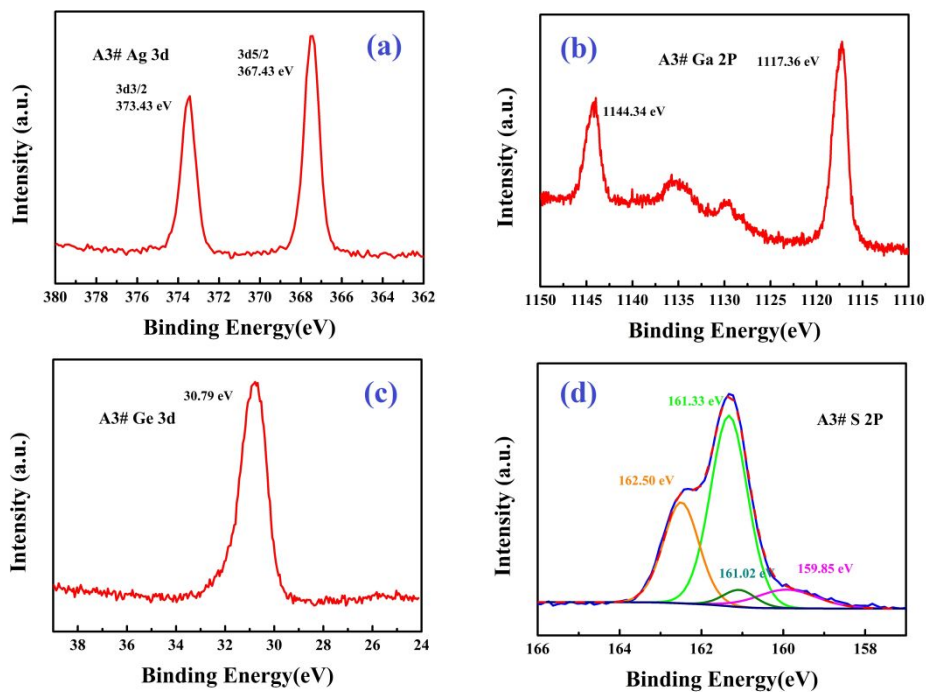


Figure S7. Detailed XPS recorded for polished surfaces of the A3# AgGaGeS₄ single crystals (a) Ag 3d; (b) Ga 2p; (c) Ge 3d; (d) S 2p

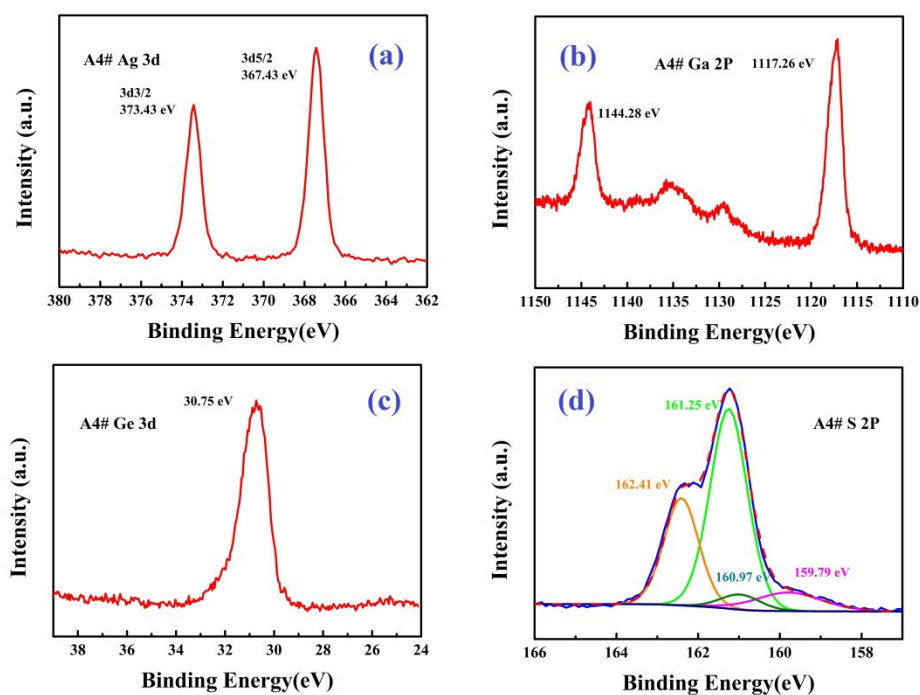


Figure S8. Detailed XPS recorded for polished surfaces of the A4# AgGaGeS₄ single crystals (a) Ag 3d; (b) Ga 2p; (c) Ge 3d; (d) S 2p

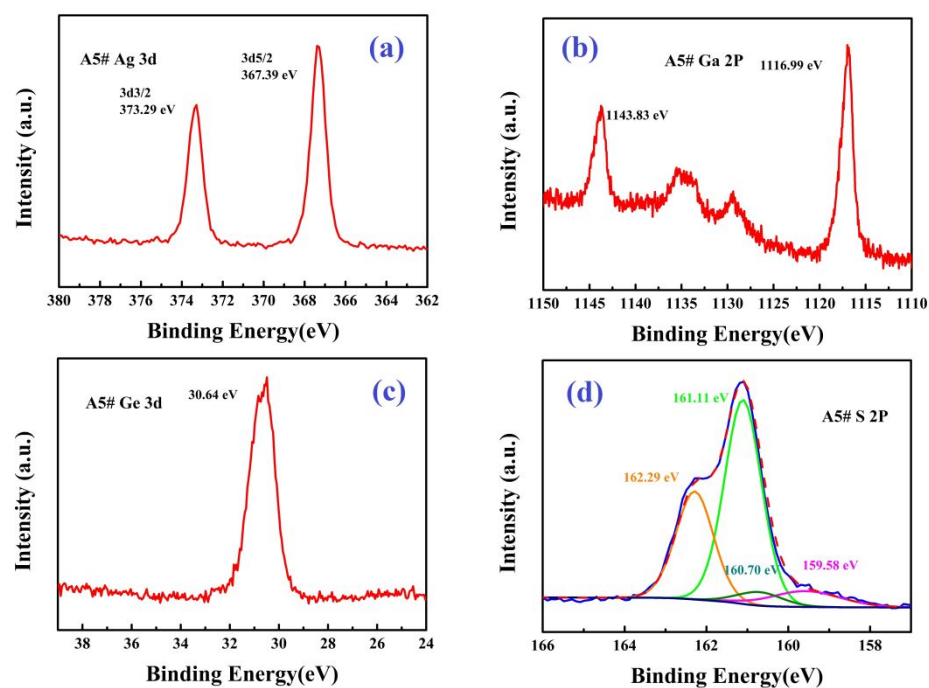


Figure S9. Detailed XPS recorded for polished surfaces of the A5# AgGaGeS₄ single crystals (a) Ag 3d; (b) Ga 2p; (c) Ge 3d; (d) S 2p

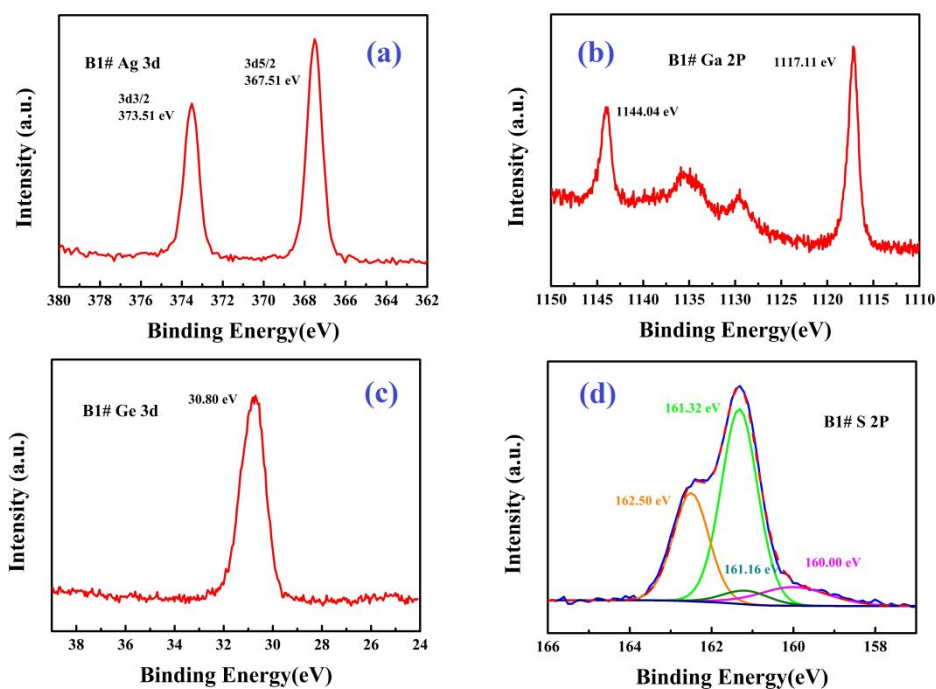


Figure S10. Detailed XPS recorded for polished surfaces of the B1# AgGaGeS₄ single crystals (a) Ag 3d; (b) Ga 2p; (c) Ge 3d; (d) S 2p

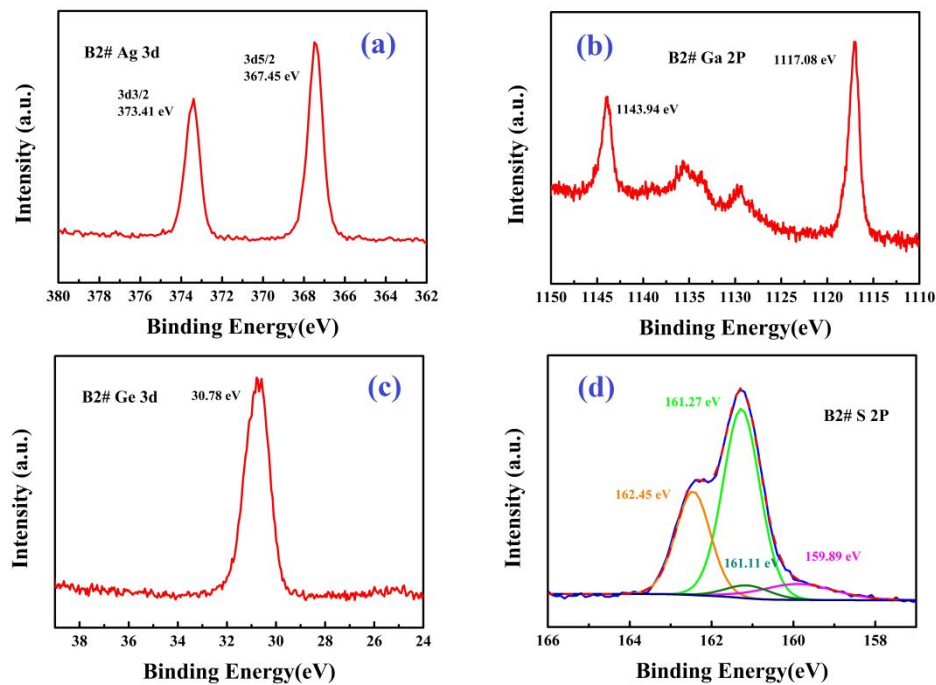


Figure S11. Detailed XPS recorded for polished surfaces of the B2# AgGaGeS₄ single crystals (a) Ag 3d; (b) Ga 2p; (c) Ge 3d; (d) S 2p

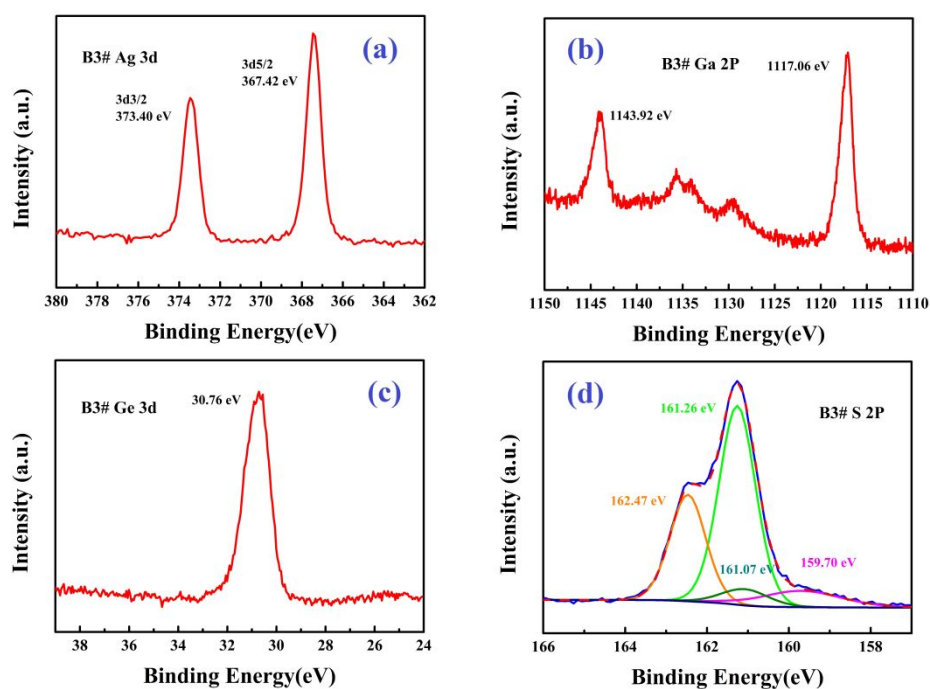


Figure S12. Detailed XPS recorded for polished surfaces of the B3# AgGaGeS₄ single crystals (a) Ag 3d; (b) Ga 2p; (c) Ge 3d; (d) S 2p

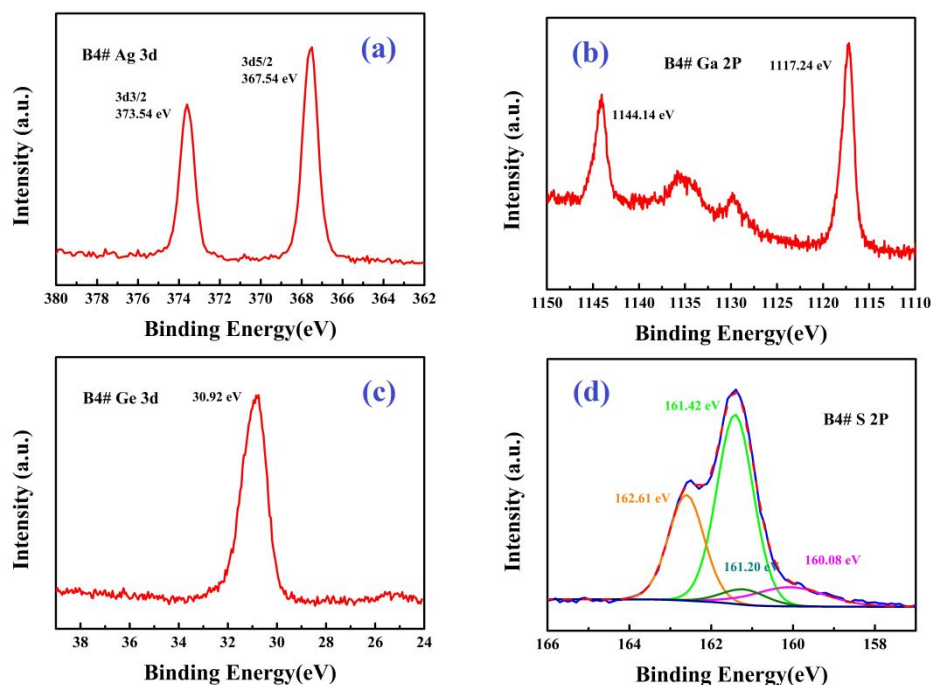


Figure S13. Detailed XPS recorded for polished surfaces of the B4# AgGaGeS₄ single crystals (a) Ag 3d; (b) Ga 2p; (c) Ge 3d; (d) S 2p

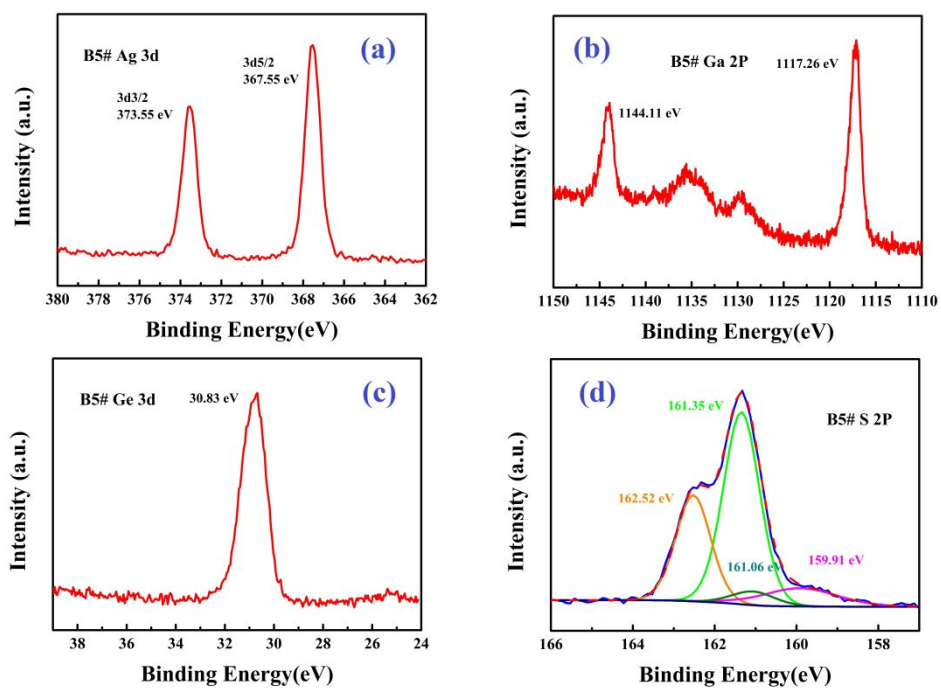


Figure S14. Detailed XPS recorded for polished surfaces of the B5# AgGaGeS₄ single crystals (a) Ag 3d; (b) Ga 2p; (c) Ge 3d; (d) S 2p