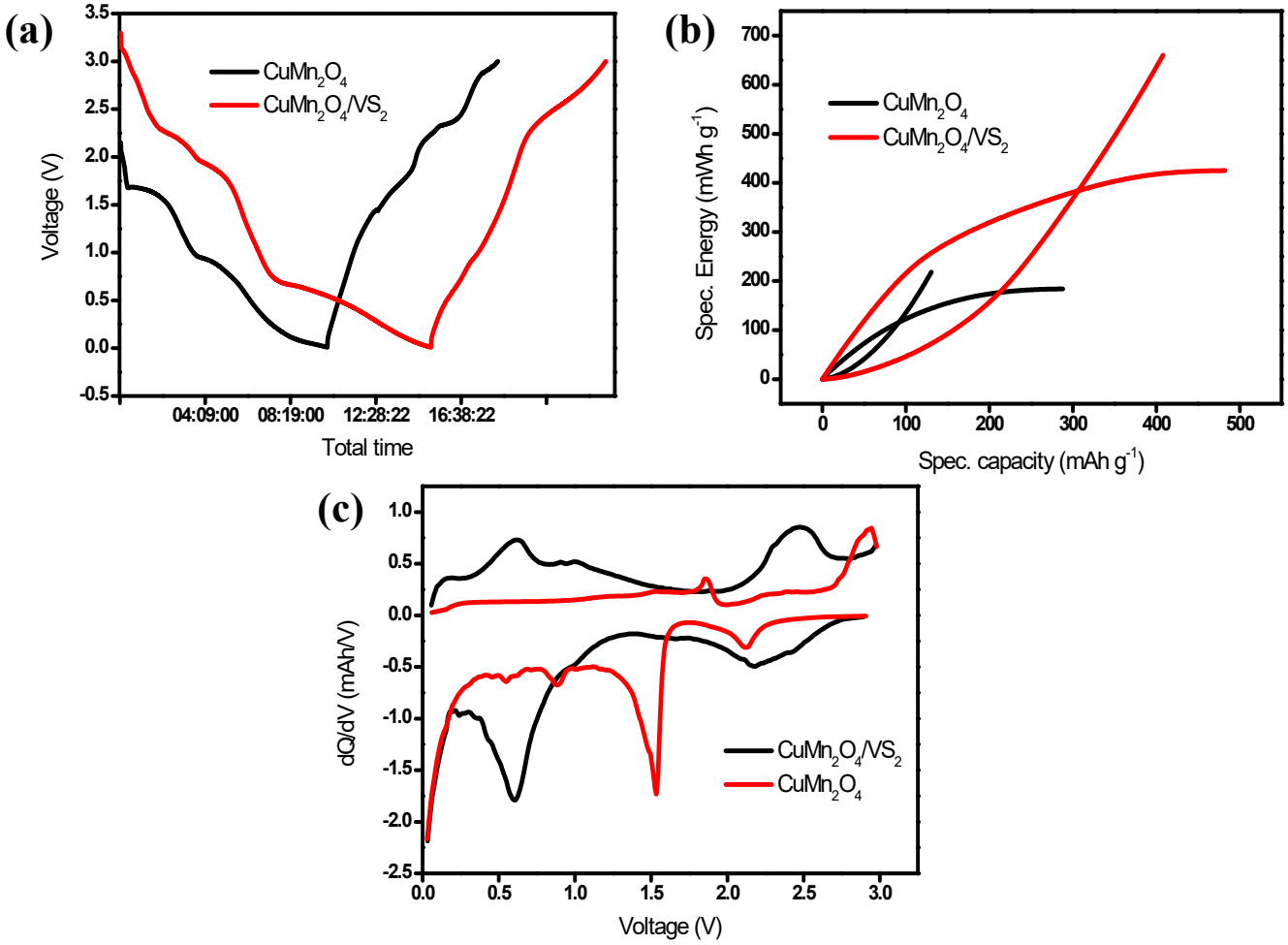

Fig. S1. (a) galvanostatic charge–discharge profiles of the $CuMn_2O_4$ and $CuMn_2O_4/VS_2$ electrodes recorded at 0.1 Ag^{-1} over time; (b) Specific energy curves at 0.1 Ag^{-1}; (c) Differential capacity (dQ/dV) profiles of $CuMn_2O_4$ and $CuMn_2O_4/VS_2$.

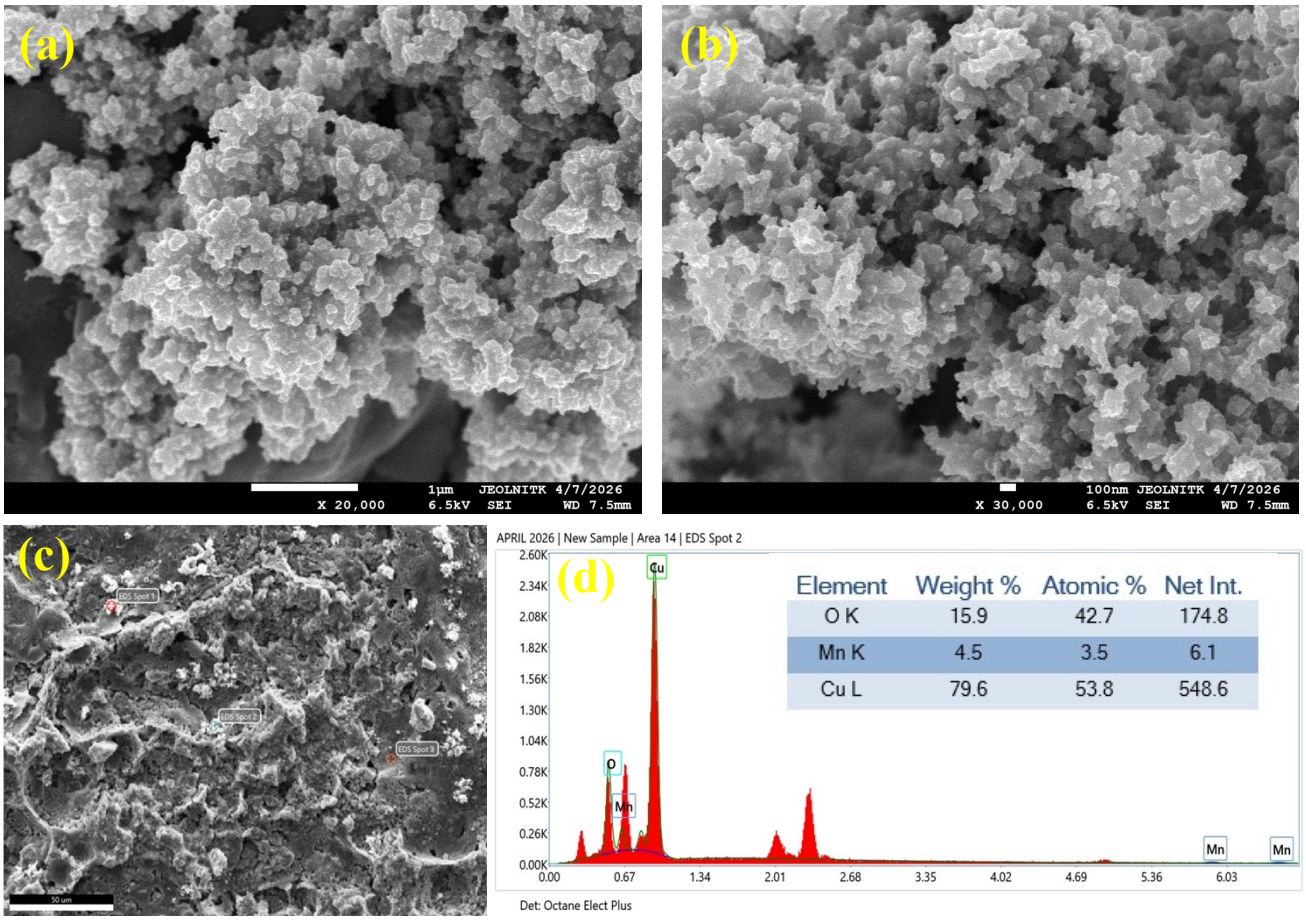

Fig. S2. FESEM image of the $CuMn_2O_4$ electrode after 500 charge–discharge cycles at a current density of 0.1 Ag^{-1}.

FESEM analysis of the pristine $CuMn_2O_4$ electrode after 500 charge–discharge cycles at 0.1 Ag^{-1}, and the results are shown in **Fig. S2**. The FESEM images (**Fig. S2a, b**) reveal severe structural degradation, with clear agglomeration and collapse of the original porous morphology into dense and irregular clusters, which significantly reduces the active surface area and hinders ion transport. This structural deterioration explains the rapid capacity fading observed in **Fig. 6e**. Additionally, EDS analysis (**Fig. S2c**) confirms the presence of Cu, Mn, and O, indicating that while the composition remains intact, the structural integrity is compromised after cycling.

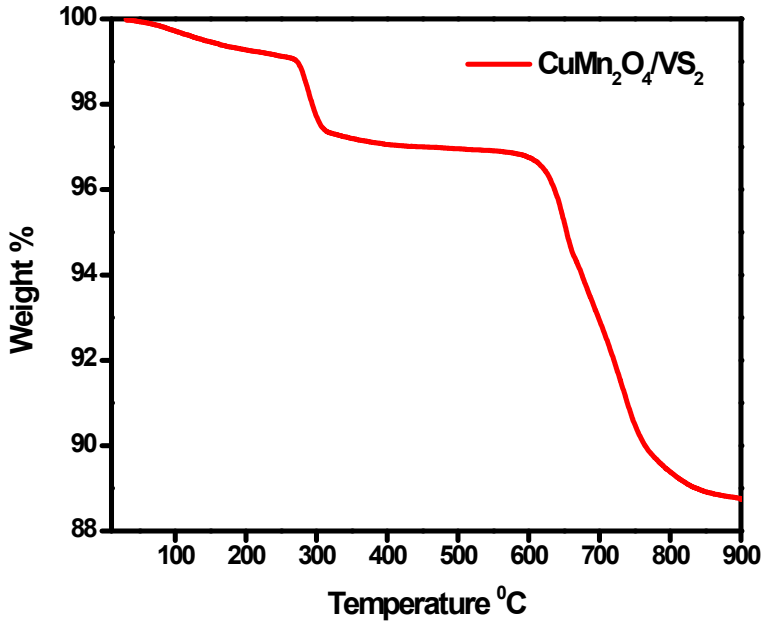

Fig. S3. TGA of $CuMn_2O_4/VS_2$

The Thermogravimetric analysis (TGA) curve of the $CuMn_2O_4/VS_2$ composite (Fig. S3) exhibits a multistep weight loss behaviour. An initial minor weight loss below 300 °C (1–2%) is attributed to the removal of physically adsorbed moisture, residual solvents, and surface hydroxyl groups. A slight decrease observed in the range of 280–350 °C can be associated with the decomposition of residual organic species from the synthesis process. The composite remains relatively stable between 350 and 600 °C, indicating good thermal stability in this temperature range. A pronounced weight loss above 600 °C is mainly due to the oxidation of the VS_2 component and the release of sulfur species, leading to the formation of stable oxide phases. Beyond 800 °C, the curve becomes nearly stable, suggesting the completion of major thermal decomposition and oxidation processes.