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Disproportionation and comproportionation reactions of resistive switching in polycrystalline NiO_x films FOREST S.-S. CHIEN, YI-TA WU, GUAN-LONG LAI, Department of Physics, Tunghai University, Y.H. LAI, Department of Chemistry, Tunghai University — The NiO_x thin film exhibit excellent bistable unipolar resistive switching, which has strong potential in nanoscale nonvolatile-memory applications. The underlying mechanism of NiO_x resistive switching is still in debate. We studied the chemical bonding states of Ni 2p and O 1s at high/low resistance spots by focused X-ray photoemission spectroscopy. The disproportionation and comproportionation reactions of $3\text{NiO} \leftrightarrow \text{Ni} + \text{Ni}_2\text{O}_3$, accounts for the resistive switching of NiO_x. The calculated Gibbs energy of the reaction indicates the reversibility of the reaction thermochemically. The dynamic breathing of the filaments with switching was observed by conducting atomic force microscopy.

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