Evidence for dynamic relaxation behavior of oxygen vacancy in Aurivillius Bi$_2$MoO$_6$
from dielectric spectroscopy during resistance switching

By Fei Guo,† Mengting Zhao,‡ Kang Xu,† Yu Huan,† Shuaipeng Ge,† Yiming Chen, † Jiahao Huang,‖ Yimin Cui,† Jincheng Zhuang,† Yi Du, †,# Haifeng Feng#, and Weichang Hao*†

†School of Physics and BUAA-UOW Joint Research Centre, Beihang University, Beijing 100191, China
‡School of Materials Science and Engineering, University of Jinan, Jinan 250022, China
‖School of Information and Electronics, Beijing Institute of Technology, Beijing 100081, China
§Beihang Experimental School, Beijing 100191, China
#Institute for Superconducting and Electronic Materials and BUAA-UOW Joint Research Centre, University of Wollongong, Wollongong, NSW 2500, Australia

Corresponding author

*Weichanghao whao@buaa.edu.cn
**Figure S1.** a) EDS spectrum of the Bi$_2$MoO$_6$ film. XPS spectra of the Bi$_2$MoO$_6$ film: b) survey spectrum. c) Bi 4f spectrum. d) Mo 3d spectrum.
Figure S2. HRS and LRS of 30 different cells.
Figure S3. $I$-$V$ characteristics for five different devices at random points in each device.
Figure S4. Electronic density of state (DOS) of Bi$_2$MoO$_6$: (a) perfect Bi$_2$MoO$_6$, (b) Bi$_2$MoO$_6$ with oxygen vacancy.
Figure S5. a) Schematic illustration of an oxygen vacancy chain in the Bi$_2$MoO$_6$ supercell with the corresponding band-decomposed charge-density of the oxygen defect state with its isosurface value. The isosurface of the charge density corresponds to 0.0019 e/A$^\text{\textdegree}$. b) The crystal structure with oxygen vacancy. The red represents Bi, the blue respresents Mo, the silver represents oxygen, and the black represents the oxygen vacancy.
**Figure S6.** Impedance spectrum of a Pt/Bi$_2$MoO$_6$/FTO cell in the initial states. The corresponding equivalent circuit is depicted in the inset.