Electronic Supplementary Material (ESI) for Inorganic Chemistry Frontiers. This journal is © the Partner Organisations 2021

Supporting Information

Oxygen vacancy enriched Cu-WO₃ hierarchical structure for thermal decomposition of ammonium perchlorate

Jing Shi,^{a,c} Xiangying Xing,^c Huixiang Wang,^{*b} Lin Ge,^a Haizhen Sun,^a Baoliang Lv *^b

^a Institutional Center for Shared Technologies and Facilities, State Key Laboratory of

Coal Conversion, Institute of Coal Chemistry, Chinese Academy of Sciences, Taiyuan,

030001, China

^b State Key Laboratory of Coal Conversion, Institute of Coal Chemistry, Chinese Academy of Sciences, Taiyuan, 030001, China.
^c University of Chinese Academy of Sciences, Beijing 100049, China

*Corresponding author. Tel: +86-0351-4063121; Fax: +86-0351-4041153; E-mail: <u>lbl604@sxicc.ac.cn</u>



Fig. S1 (a) SEM image of Cu-WO₃ NANF, (b) the EDS spectrum of selected area in Fig. S1a, (c-e) elemental distribution mapping of Cu-WO₃ NANF. The inset in S1b is the percentage of element

composition.



Fig. S2 SEM images of WO3 NASS at (a) low magnification, (b) side view of partial enlargement



of single saucer and (c) XRD pattern of WO3 NASS.

Fig. S3 The XRD comparison of Cu-WO₃ NANF with standard spectra of Cu and Cu compounds.



Fig. S4 (a) TEM image of typical WO₃ NASS fragment, (b) HRTEM analysis of area b in S4a, and (c) the corresponding SAED pattern taken from the red region in S4b.

A fraction of nanorod array dropped from the WO₃ NASS after ultrasound, and its TEM image is presented in **Fig. S4**. The alternating light and dark stripes indicate an array structure, and the nanorod shows different length. In the HRTEM image (**Fig. S4b**), it is easy to identify the lattice fringes of (001) planes, and the corresponding interplane distance is 0.384 nm. The SAED pattern (**Fig. S4c**) is attributed to (001), (111), (110) planes and/or their equivalent planes under the incident electron beam along the [-110] direction.



Fig. S5 N₂ adsorption-desorption isotherms of WO₃ NASS and Cu-WO₃ NANF.



Fig. S6 The atomic structure of WO₃ (001) crystal plane.



Fig. S7 DSC curves of pure AP and the mixture of AP with WO₃ NASS or Cu-WO₃ NANF at different heating rates: (a) 5 °C/min, (b) 10 °C/min, (c) 15 °C/min and (d) 20 °C/min.



Fig. S8 Plots of $\ln(\beta/T_p^2)$ versus reciprocal peak temperature $1/T_p$ for different systems (a) pure AP, a mixture of AP with (b) WO₃ NASS and (c) Cu-WO₃ NANF.



Fig. S9 EPR spectra of WO₃ NASS and Cu-WO₃ NANF at room temperature.



Fig. S10 Ion current versus temperature curves of ion fragments during the thermal decomposition





Fig. S11 The comparison of (a) N_2 and (b) NO ion current curves in two different decomposition

processes.