Supporting Information

Tunable Polaron-induced Coloration of Tungsten Oxide via a Multi-step Control of Physicochemical Property for Gaseous F Detection

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\[ E_g = 3.02 \text{ eV} \]

Figure S1. The extracted optical band gap of tungsten oxide from Tauc plot
In Fig. S2, The sample was exposed to HF vapor by heating the 40% HF solution in air atmosphere and also, was exposed to pure water vapor by boiling DI water to confirm the selectivity against of H\textsubscript{2}O. The experiment was performed by boiling HF solution (40% concentration) in the hood at 50 Celsius degree (Video attached). The bleaching of tungsten oxide by HF exposure was observed within about 10 minutes. In the case of H\textsubscript{2}O exposure, however, any change of colorimetric was not observed while water boiling was proceeded at 100 Celsius degree for 1 hour. It is shown that the polaron-induced H-WO\textsubscript{3-x} is selective for the fluorine species in gas phase XeF\textsubscript{2} and HF since H-WO\textsubscript{3-x} did not react with H\textsubscript{2}O.
Figure S3. UPS spectra of a) pristine, b) H-WO$_{3-x}$, and c) F-WO$_{3-x}$, respectively.