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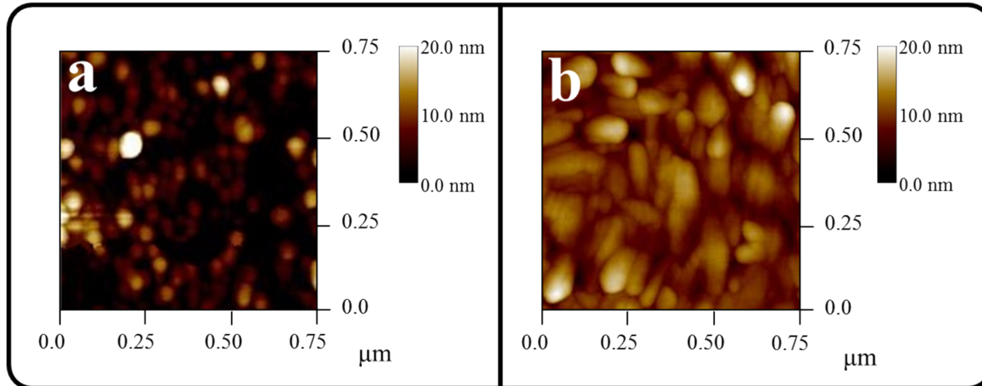
Electronic Supplementary Information

1. Lattice constants and symmetries obtained from the least-square fitting analyses for the thin films grown in Ar and Ar/O_2 mixed ambients are summarized in the table.

samples	a (nm)	b (nm)	c (nm)	symmetry	chemical formula
Ar	0.498	0.498	1.404	Rhombohedral	V_2O_3
Ar/O_2	1.152	0.357	0.437	Orthorhombic	V_2O_5

2. (a) AFM image of the V_2O_3 thin film. (b) AFM image of the V_2O_5 film. The root-mean-square (RMS) surface roughness of the V_2O_3 film was approximately 18 nm. RMS surface roughness of the V_2O_5 film was 3.33 nm.



3. XPS analyses of the V_2O_3 and V_2O_5 films: (a) $V2p_{3/2}$ spectrum of the V_2O_3 film. (b) O1s spectrum of the V_2O_3 film. (c) $V2p_{3/2}$ spectrum of the V_2O_5 film. (d) O1s spectrum of the V_2O_5 film.