Boosted Dehydrogenation of Ethane in Porous Vanadium-based Single Crystals

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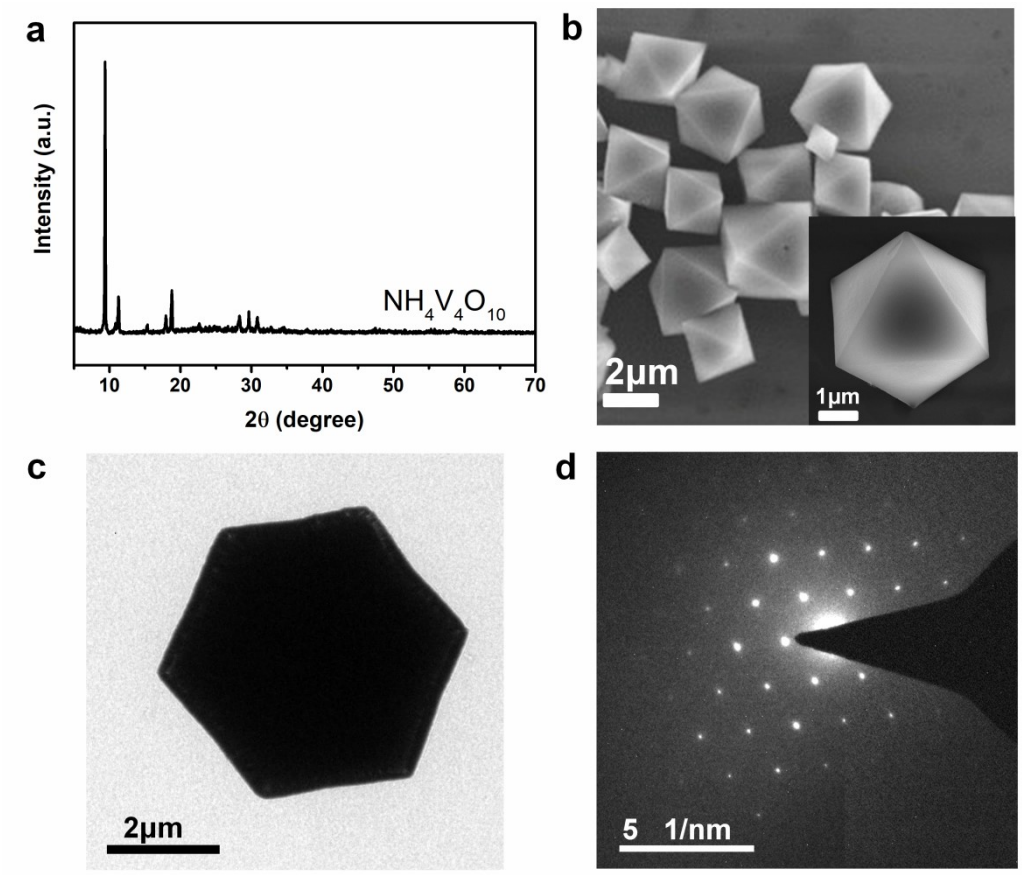

Fig. S1 (a) XRD, (b) SEM, (c) TEM and (d) HR-TEM images of $NH_4V_4O_{10}$ powder.

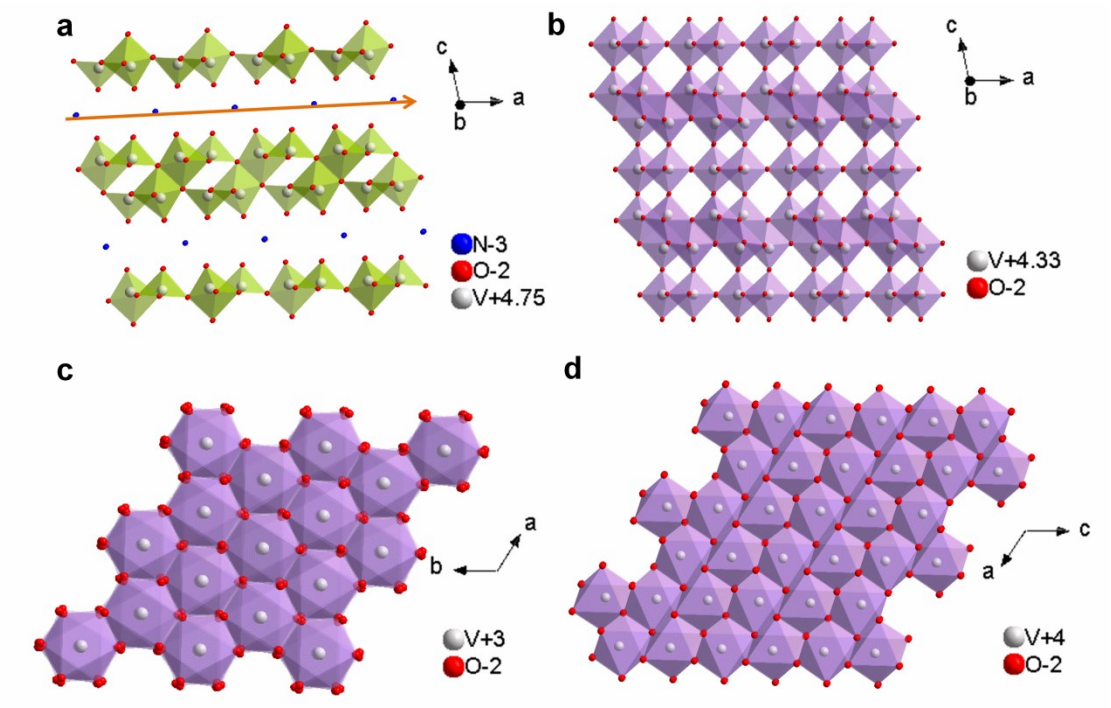

Fig. S2 (a) The lattice channel of atomic evaporation of $NH_4V_4O_{10}$ and the lattice structure of (b) V_6O_{13}, (c) VO_2 and (d) V_2O_3.

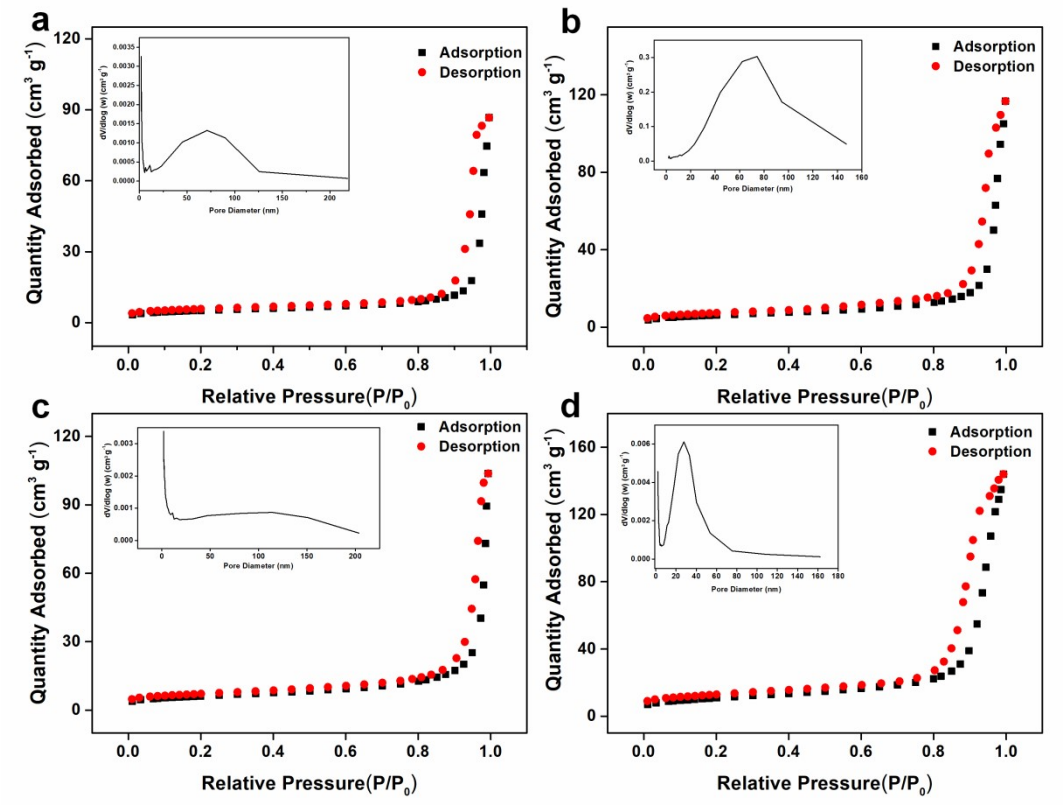

Fig. S3 N_2 adsorption-desorption isotherms and (inset) the corresponding pore diameter distribution of porous single crystal micron particles, (a) V_6O_{13}, (b) VO_2, (c) V_2O_3 and (d) VN.

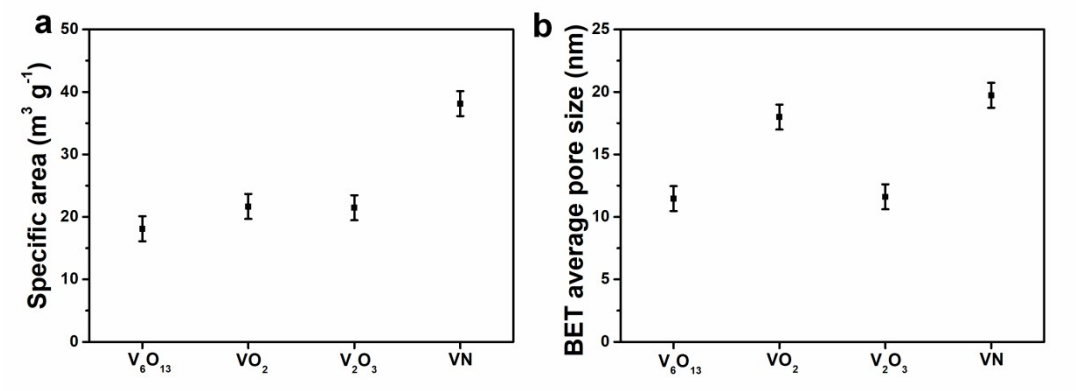

Fig. S4 The surface specific area (a) and average pore size (b) of the porous single crystal micro particles (The error bar indicates the standard deviation in repeated measurements).

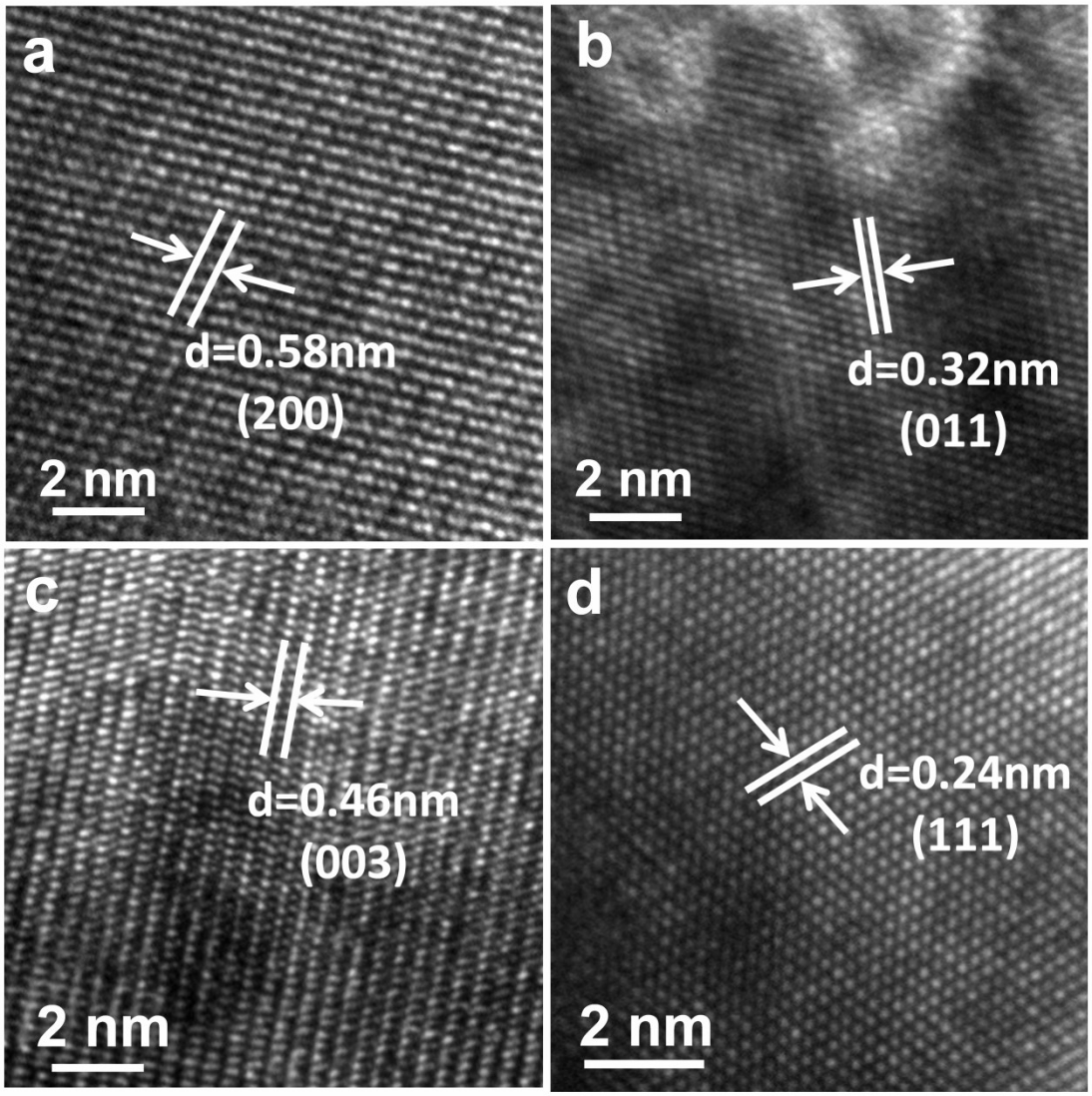

Fig. S5 HR-TEM images of (a) V_6O_{13}, (b) VO_2, (c) V_2O_3 and (d) VN porous single crystal micro particles.

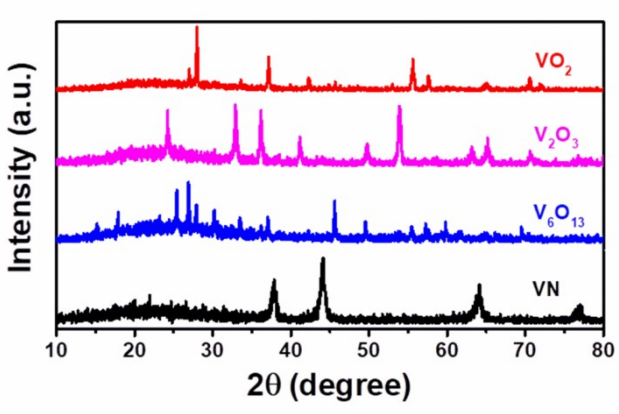

Fig. S6 XRD of V_6O_{13}, VO_2, V_2O_3 and VN single crystal powders after ethane dehydrogenation.

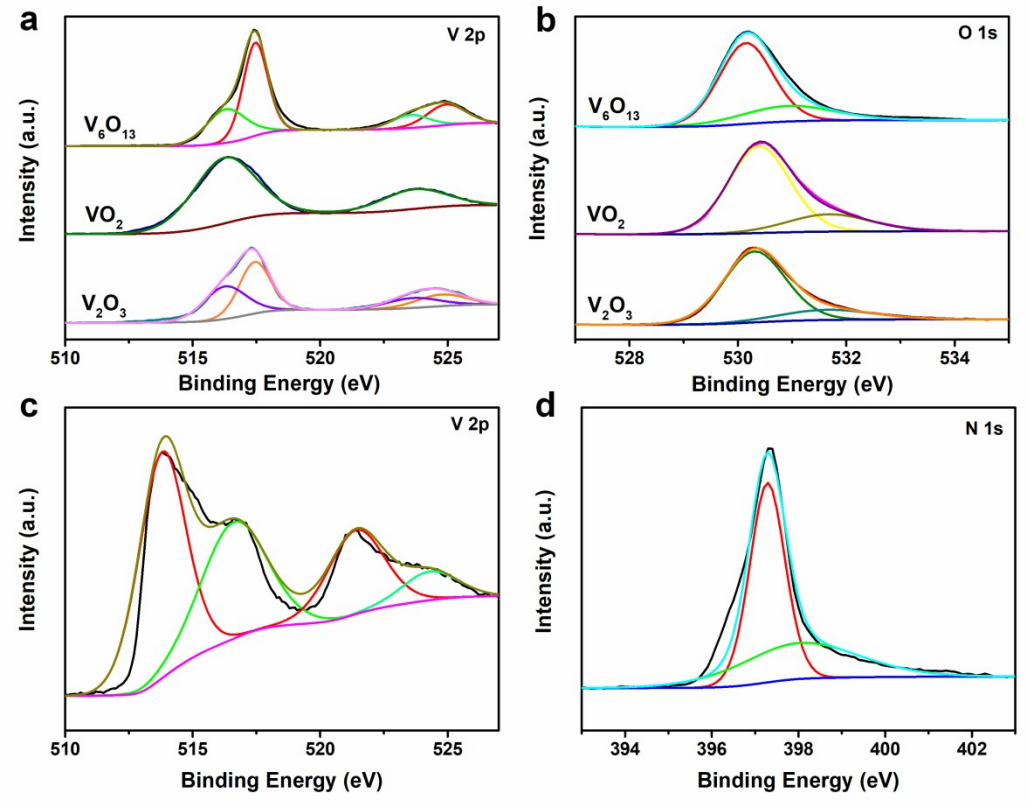

Fig. S7 XPS spectra of PSC V_6O_{13}, VO_2, V_2O_3 and VN powders after ethane dehydrogenation. (a) V 2p peaks of V_6O_{13}, VO_2 and V_2O_3. (b) O 1s peaks of V_6O_{13}, VO_2 and V_2O_3. (c) V 2p peaks of VN. (d) N 1s peaks of VN.

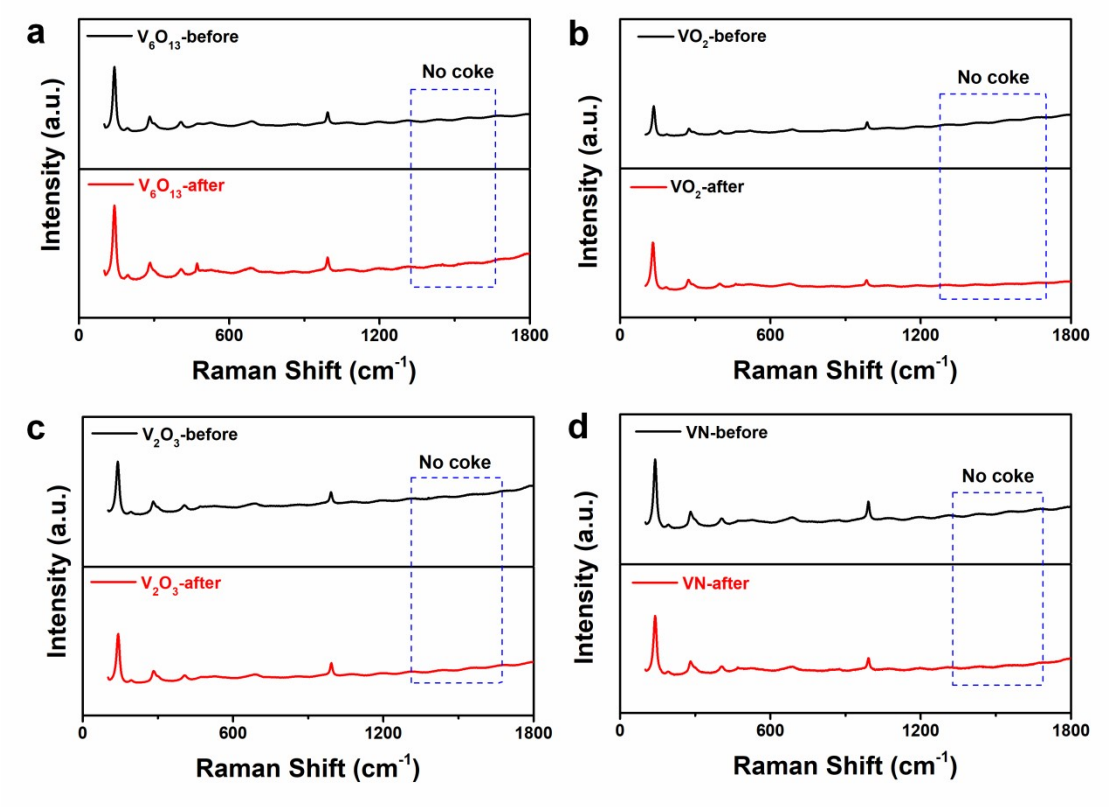

Fig. S8 Raman images of (a) V_6O_{13}, (b) VO_2, (c) V_2O_3 and (d) VN powders before (black line) and after (red line) the dehydrogenation of ethane reaction.

Table S1 The ICP and EA results of vanadium-based materials.

Samples	Contents of V (wt)	Contents of O or N (wt)
V_6O_{13}	59.64%	10.62%
VO_2	44.87%	20.06%
V_2O_3	58.02%	20.87%
VN	74.82%	21.08%