ESI (Electronic Supplementary Information)

Title:

Elucidation of catalytic NOx reduction mechanism in an electric field at low temperatures

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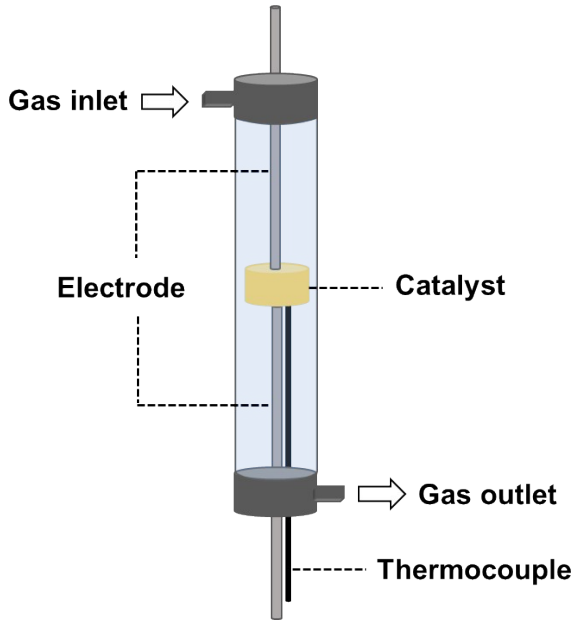

Figure S1. A schematic image of the activity test reactor.

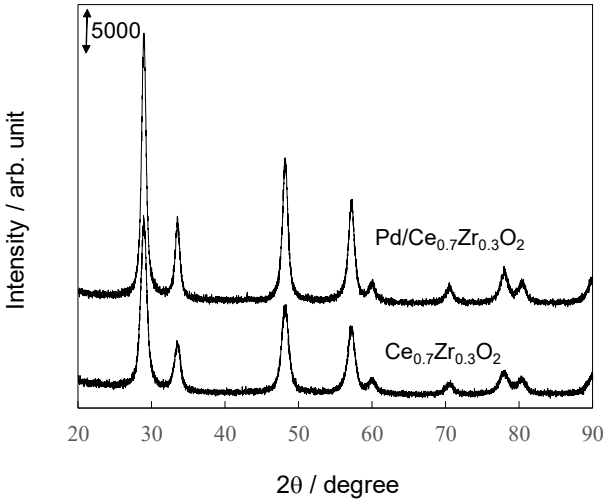

Figure S2. XRD spectra for the prepared catalysts.

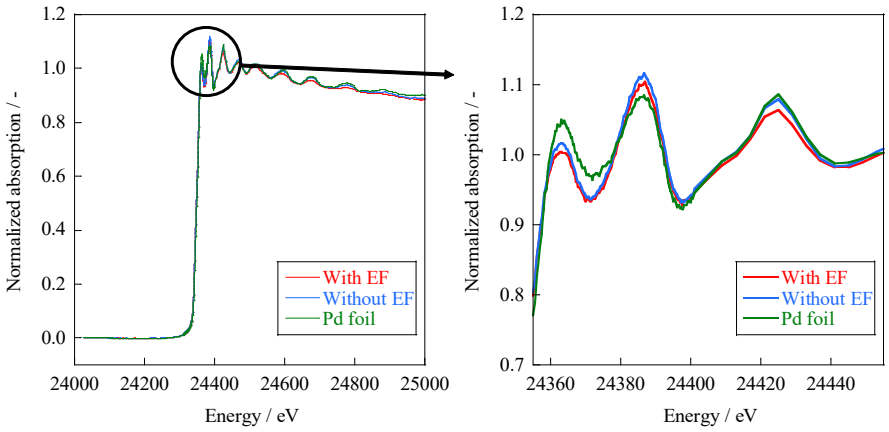

Figure S3. *In situ* Pd *K*-edge XANES spectra of $Ce_{0.7}Zr_{0.3}O_2$ under NO-CO-C_3H_6-O_2 reaction (NO: 2500 ppm, CO: 3000 ppm, C_3H_6: 500 ppm, O_2 2500 ppm, Ar balance, total flow: 200 cc min^{-1}) with/without the electric field (3 mA) at 373 K.

We conducted *in-situ* XAFS measurement in a reaction gas atmosphere (NO-CO-C_3H_6-O_2) at 373 K after H_2 reduction to evaluate the electronic state of Pd supported by $Ce_{0.7}Zr_{0.3}O_2$. Fig. S3 depicts spectra for the Pd K-edge of Pd/$Ce_{0.7}Zr_{0.3}O_2$ with and without the electric field. As Fig. S3 shows, Pd loaded on $Ce_{0.7}Zr_{0.3}O_2$ was in the metallic state with or without the application of the electric field.

No change in the electronic state of Pd attributable to application of the electric field was observed.

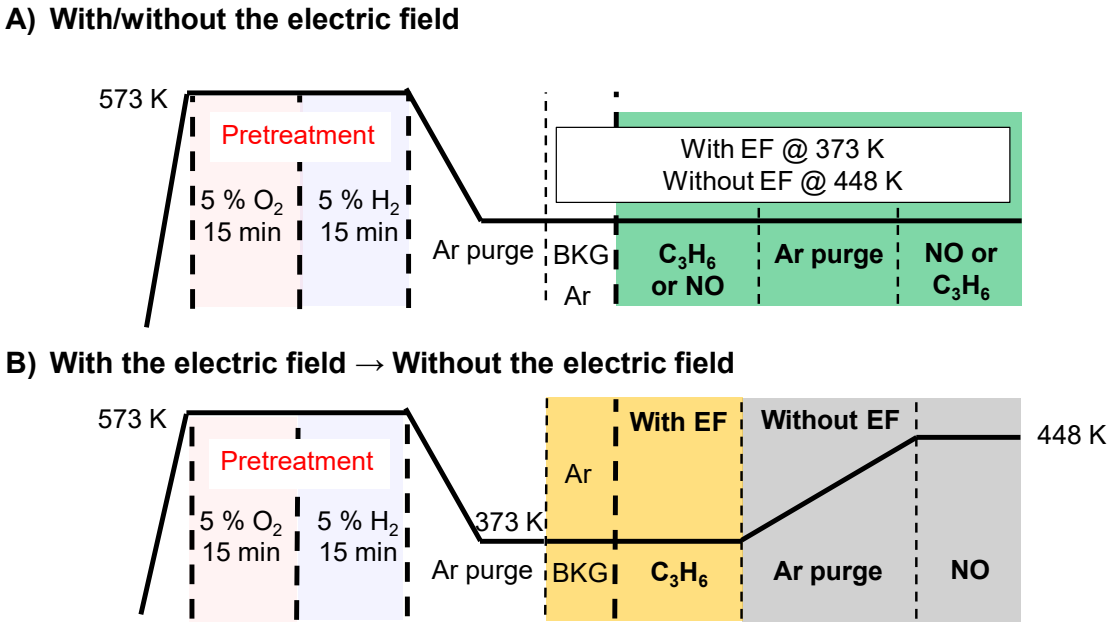

Figure S4. Protocol for *in-situ* DRIFTS measurement (A) with/without the electric field (3 mA) at each temperature (with: 373 K, without: 448 K) (B) with the electric field (3 mA) when dosing C_3H_6 at 373 K → without the electric field when dosing NO at 448 K

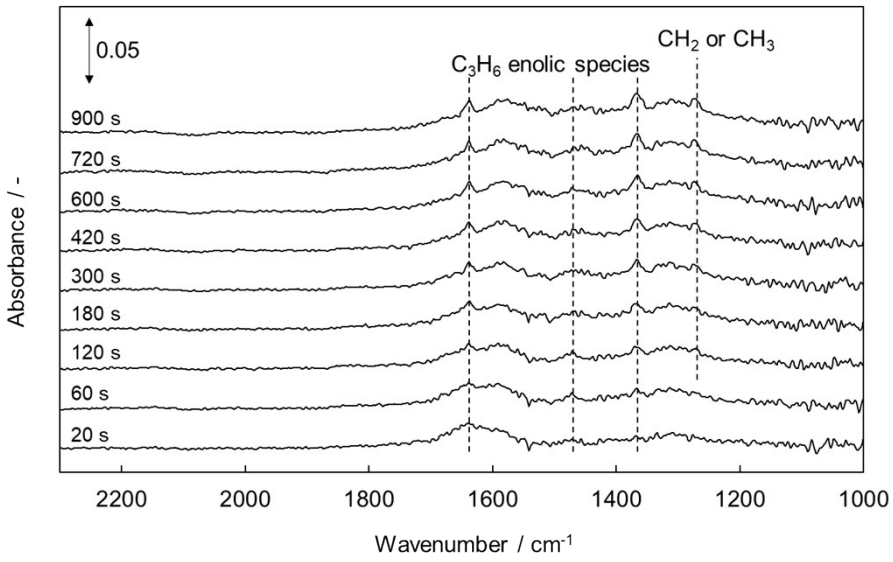

Figure S5. 2D graph for the DRIFT spectra of $Pd/Ce_{0.7}Zr_{0.3}O_2$ during the transient test (switching from C_3H_6 to NO flow) without the electric field at 448 K.

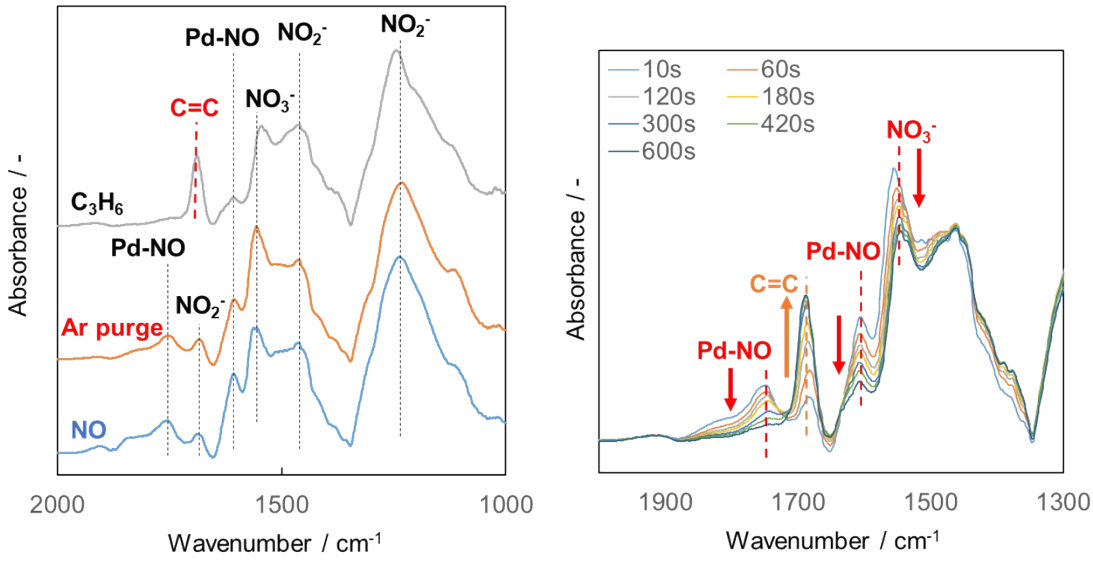

Figure S6. DRIFT spectra of $Pd/Ce_{0.7}Zr_{0.3}O_2$ during transient test (switching from NO to C_3H_6 flow) without the electric field at 448 K.

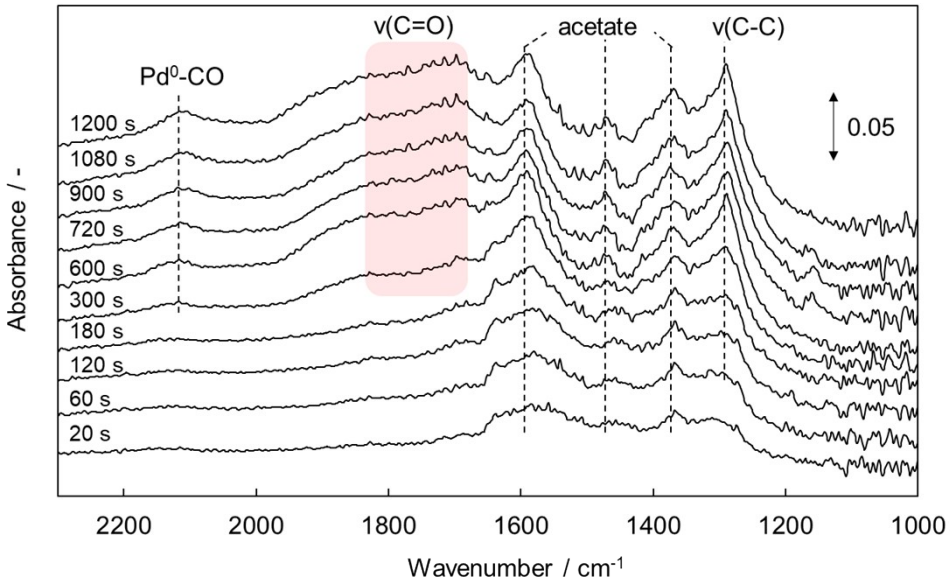

Figure S7. 2D graph for the DRIFT spectra of $Pd/Ce_{0.7}Zr_{0.3}O_2$ during the transient test (switching from C_3H_6 to NO flow) with the electric field (3 mA) at 373 K.

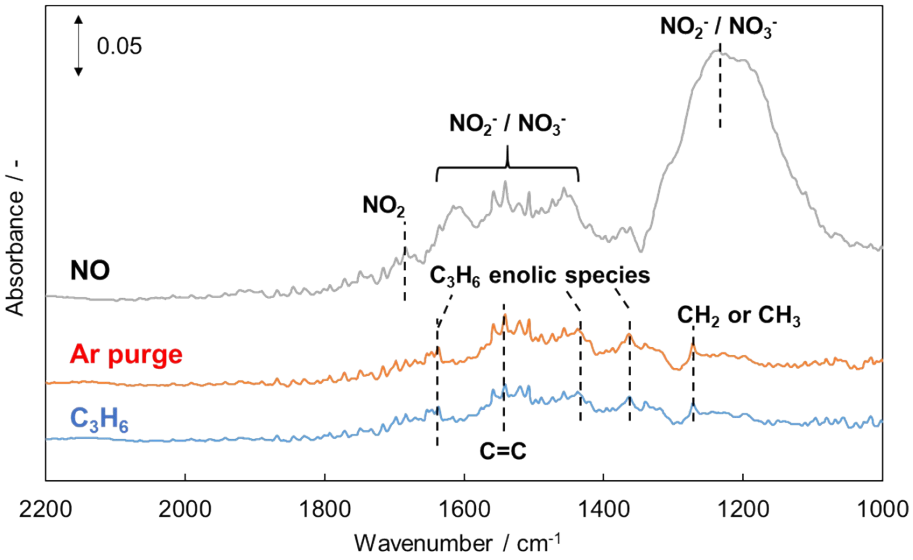

Figure S8. DRIFT spectra of $Pd/Ce_{0.7}Zr_{0.3}O_2$ during the transient test (switching from C_3H_6 to NO flow) without the electric field at 373 K.

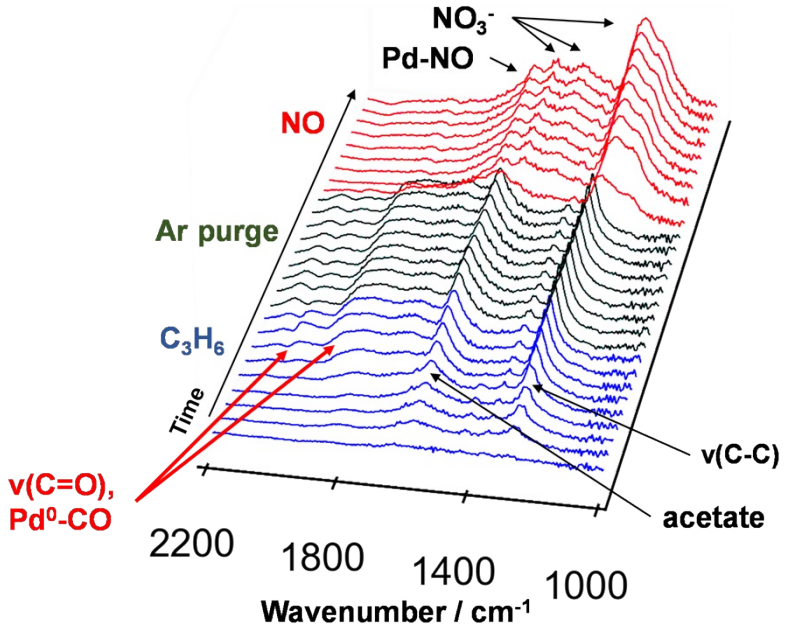

Figure S9. DRIFT spectra of $Pd/Ce_{0.7}Zr_{0.3}O_2$ during transient test (switching from C_3H_6 to NO flow) with the electric field (3 mA) when dosing C_3H_6 at 373 K → without the electric field when dosing NO at 448 K.

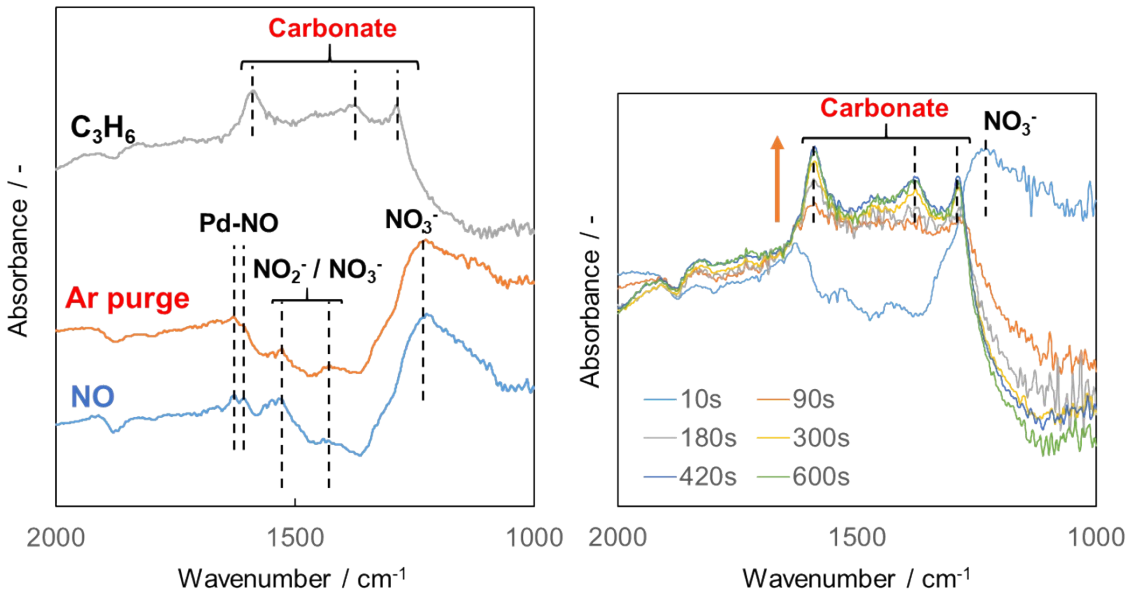

Figure S10. DRIFT spectra of Pd/$Ce_{0.7}Zr_{0.3}O_2$ during transient test (switching from NO to C_3H_6 flow) with the electric field at 373 K.

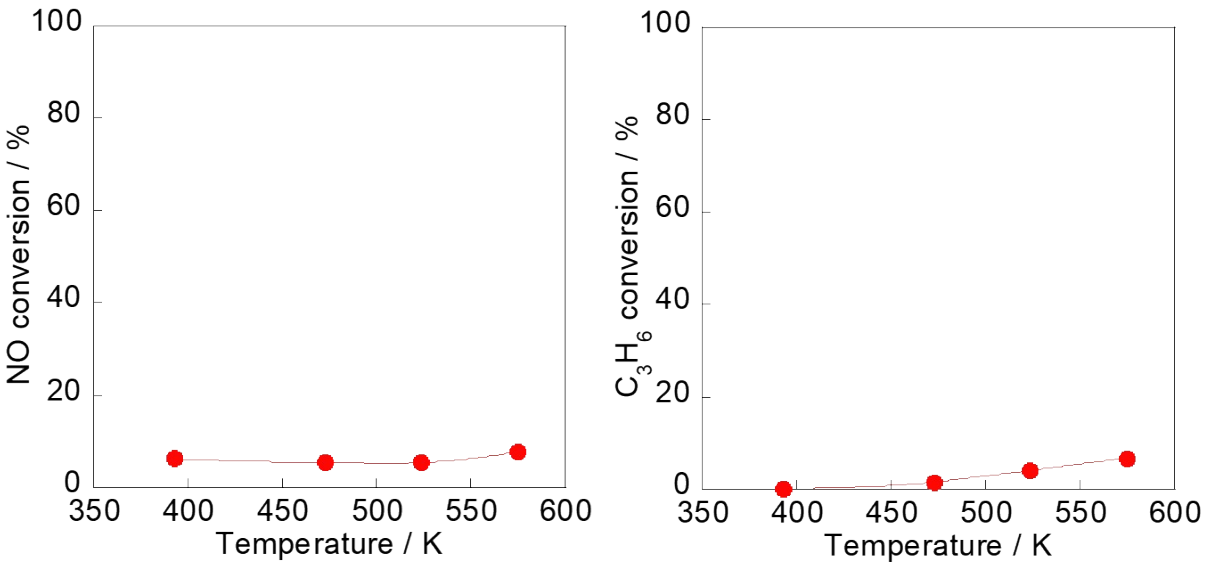

Figure S11. NO and C_3H_6 conversion over $Ce_{0.7}Zr_{0.3}O_2$ under NO–C_3H_6 reaction (NO: 2700 ppm, C_3H_6: 300 ppm, Ar balance, SV: 108 800 h^{-1}) applying 3.0 mA direct current.

Table S1 BET specific surface area

	Surface area /m^2 g^{-1}
$Pd/Ce_{0.7}Zr_{0.3}O_2$	14
$Ce_{0.7}Zr_{0.3}O_2$	16