Tables used in manuscripts

Table S1. Reaction pathways in 2-way DPF/SCR

Domain	Reaction Type	Reaction Pathway
Soot cake layer	Soot oxidation by O_2	$C+(1-f_{CO}/2)O_2 \rightarrow f_{CO}CO+(1-f_{CO}/2)CO_2$
	Soot oxidation by NO_2	$C+(2-g_{CO})NO_2 \rightarrow g_{CO}CO+(1-g_{CO})CO_2+(2-g_{CO})NO$
Catalytic filter wall	Catalytic soot oxidation by O_2	$C+(1-f_{CO,cat}/2)O_2 \rightarrow f_{CO,cat}CO+(1-f_{CO,cat}/2)CO_2$
	Soot oxidation by NO_2	$C+(2-g_{CO})NO_2 \rightarrow g_{CO}CO+(1-g_{CO})CO_2+(2-g_{CO})NO$
	Ammonia adsorption	$NH_3 + S \rightarrow NH_3\text{-}S$
	Ammonia desorption	$NH_3\text{-}S \rightarrow NH_3 + S$
	Ammonia oxidation	$2NH_3\text{-}S + 3/2O_2 \rightarrow N_2 + 3H_2O + 2S$
	NO oxidation	$NO + 1/2O_2 \leftrightarrow NO_2$
	Standard SCR reaction	$4NH_3\text{-}S + 4NO + O_2 \rightarrow 4N_2 + 6H_2O + 4S$
	Fast SCR reaction	$2NH_3\text{-}S + NO + NO_2 \rightarrow 2N_2 + 3H_2O + 2S$
	NO_2 SCR reaction	$3NO_2 + 4NH_3\text{-}S \rightarrow 3.5N_2 + 6H_2O + 4S$
	N_2O formation	$2NO_2 + 2NH_3\text{-}S \rightarrow N_2O+N_2+ 3H_2O + 2S$

Table S2. Rate expressions for SCR reactions

Reaction type	Rate Expression
Ammonia adsorption	$RR_{ads} = A_1 C_{NH3}(1-\theta)$ A_1=3.737
Ammonia desorption	$\mathrm{RR}_{des} = A_2 \exp\left(\frac{-E_{A,2}}{R_u T}\right)\theta$, where $E_{A,2} = E_{A,des1}e^{-\delta\theta} + E_{A,des2}$ A_2=1E+11, $E_{A,des1}$=50000 [J/mol], δ=4.5, $E_{A,des2}$=102000 [J/mol]
Ammonia oxidation	$RR_{NH3,oxi} = A_3 \exp\left(\frac{-E_{A,3}}{R_u T}\right) C_{O2} \cdot \theta$ A_3=1.44E+11, $E_{A,3}$=162400 [J/mol]
NO oxidation	$\mathrm{RR}_{NO,oxi} = A_4 \exp\left(\frac{-E_{A,4}}{R_u T}\right) C_{NO}\sqrt{C_{O2}} \cdot \theta - k_{4,b} C_{NO2}$ $k_{4,b} = A_4 \exp\left(\frac{-E_{A,4}}{R_u T}\right)/K_{eq}$ $K_{eq} = \exp\left(\frac{-\Delta \mathrm{S}}{R_u}\right)\exp\left(\frac{-\Delta \mathrm{H}}{R_u \mathrm{T}}\right)$ A_4=3.0E+1, $E_{A,4}$=48000, $\Delta \mathrm{S} = -76.1$ [J/K-mol], $\Delta \mathrm{H}$=58279 [J/mol]
Standard SCR reaction	$\mathrm{RR}_{std,SCR} = A_5 \exp\left(\frac{-E_{A,5}}{R_u T}\right) C_{NO} \cdot \theta$ A_5= 5.04E+8, $E_{A,5}$=84300 [J/mol]
Fast SCR reaction	$\mathrm{RR}_{fast,SCR} = A_6 \exp\left(\frac{-E_{A,6}}{R_u T}\right) C_{NO} C_{NO2} \cdot \theta$ A_6 = 9E+11, $E_{A,6}$=66100 [J/mol]
NO_2 SCR reaction	$\mathrm{RR}_{NO2,SCR} = A_7 \exp\left(\frac{-E_{A,7}}{R_u T}\right) C_{NO2} \cdot \theta$ A_7 =1.1E+7, $E_{A,7}$=71800 [J/mol]
N_2O formation	$\mathrm{RR}_{N2O} = A_8 \exp\left(\frac{-E_{A,8}}{R_u T}\right) C_{NO2} \cdot \theta$ A_8=3.6E+4, $E_{A,8}$=43300 [J/mol]

Table S3. Catalyst Core dimension of blended DPF/SCR sample and aging conditions

Catalyst Core Dimensions	Length	0.0605 [m] , 0.95 [in]
	Diameter	0.0241 [m] , 2.38 [in]
	Cell Density	300 CPSI
	Substrate Porosity	59 %
	Mean Pore Diameter	18 [μm]
Aging Conditions		100h / 700 ℃ + 20h / 750 ℃ (Air / 10% H_2O) , SV=60000 [1/h]

Table S4. Test Conditions for NO oxidation and NO_2 dissociation

Test		NO oxidation to NO_2	NO_2 dissociation to NO
Space velocity		23500 1/hr	23500 1/hr
Sample catalyst condition		Clean (free from soot loading)	Clean (free from soot loading)
Feed gas composition	O_2	5 % / 10 %	5 %
	NO	500 ppm	0 ppm
	NO_2	0 ppm	100 ppm
	H_2O	5 %	5 %
	N_2	Balance	Balance

Table S5. Test conditions for soot oxidation studies

Test		'test 1'	' test 2'
Space velocity		23500 1/hr	23500 1/hr
Initial soot loading		Soot loaded (3g/L)	Soot loaded (1.9g/L)
Feed gas composition	O_2	5 %	5 %
	NO	500 ppm	0 ppm
	NO_2	0 ppm	100 ppm
	H_2O	5 %	5 %
	N_2	Balance	Balance

Table S6. Activation energy determined from soot oxidation measurements

Oxidation Mechanism	Activation Energy (current calibration)	Activation Energy (literature)
Thermal Soot Oxidation by O_2	158 kJ/mol	125 ~ 177 kJ/mol
Catalytic Soot Oxidation by O_2	110 kJ/mol	100 ~ 120 kJ/mol
Soot oxidation by NO_2	70 kJ/mol	40 ~ 70 kJ/mol

Table S7. Comparison of mass transfer inside filter wall between clean and soot loaded conditions

		Clean case	Soot loaded case
Mass transfer	Mechanism	Diffusion	Knudsen diffusion
	Rate	Fast	Slow

Table S8. Test condition for the results in Figure 11 to Figure 14

Space Velocity		23500 1/hr
Initial soot loading		Clean(0g/L) or 1.0g/L
Initial ammonia storage		0 g
Feed gas composition	NO	200 ppm
	NH_3	180 ppm
	O_2	5%
	H_2O	5%
	N_2	Balance
Temperature		200 ~ 600 ℃ (programmed temperature)

Table S9. Test condition for the results in Figure 15 to Figure 18

Space Velocity		23500 1/hr
Initial soot loading		3.0g/L
Feed gas composition	NO_x	200 ppm
	NO_2/NO_x	0.25, 0.375, 0.5, 0.625, 0.75 respectively
	NH_3	180 ppm
	O_2	5%
	H_2O	5%
	N_2	Balance
Temperature		400 ℃