Supplementary data

Table S1 Detailed information of tested vehicles.

Vehicle number	Manufacturer	Model	Year	Emission standard	Aftertreatments	Mass (kg)	Mileage (km)	Engine displacement (L)	Maximum net power (kW)	Fuel injection system
G1	Chevrolet	Malibu	2017	China 5	TWC	1687.8	123312	1.490	120	GDI [a)]
G2	Chevrolet	Cruze	2017	China 5	TWC	1493.5	171835	1.490	84	GDI
G3	Honda	Breeze	2021	China 6	TWC+GPF	1733	5353	1.498	142	GDI
G4	Toyota	Camry	2017	China 6	TWC	1758	5212	2.487	154	GDI

Notes: a) Gasoline direct injection.

Table S2 EFs of air pollutants for tested vehicles over entire WLTC cycles.

EFs	G1	G2	G3	G4
NO_x (mg/km)	10.42 ± 2.75	16.13 ± 3.15	4.47 ± 0.96	4.81 ± 0.82
CO_2 (kg/km)	0.164 ± 0.005	0.143 ± 0.002	0.165 ± 0.002	0.154 ± 0.001
CO (mg/km)	432.62 ± 76.9	229.63 ± 63.05	62.32 ± 7.57	99.41 ± 18.50
THC (mg/km)	16.29 ± 2.86	9.48 ± 6.11	5.29 ± 2.50	12.48 ± 1.37

Table S3 Average EFs for tested vehicles under cold- and hot-start conditions during WLTC cycle.

EFs	China 5 LDGVs		China 6 LDGVs	
	Cold-start	**Hot-start**	**Cold-start**	**Hot-start**
NO_x (mg/km)	11.75 ± 3.54	14.80 ± 2.06	5.06 ± 0.27	4.45 ± 1.24
CO_2 (kg/km)	0.157 ± 0.003	0.150 ± 0.002	0.161 ± 0.003	0.158 ± 0.001
CO (mg/km)	357.42 ± 64.93	304.77 ± 133.94	90.67 ± 21.64	58.61 ± 5.58
THC (mg/km)	17.39 ± 1.68	8.38 ± 5.00	10.23 ± 2.80	6.48± 4.23

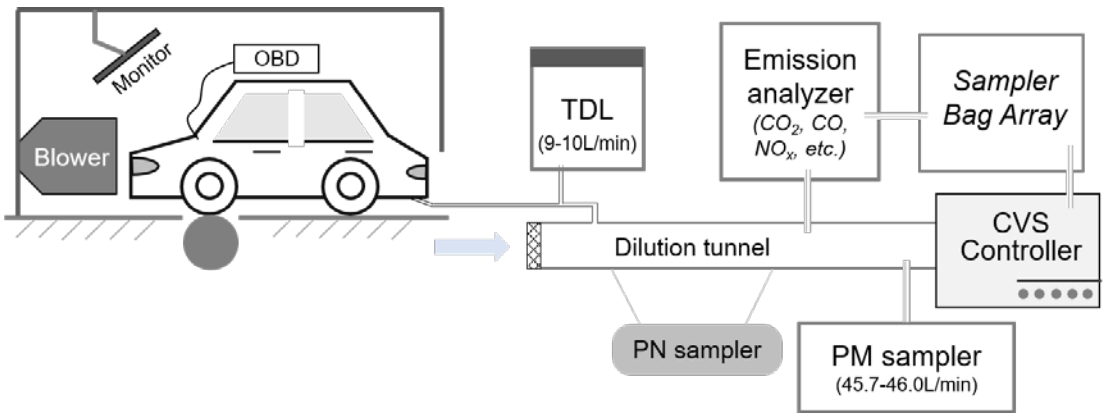

Fig. S1 The constant volume sampling (CVS) system of vehicle exhaust emission based on automobile chassis dynamometer.

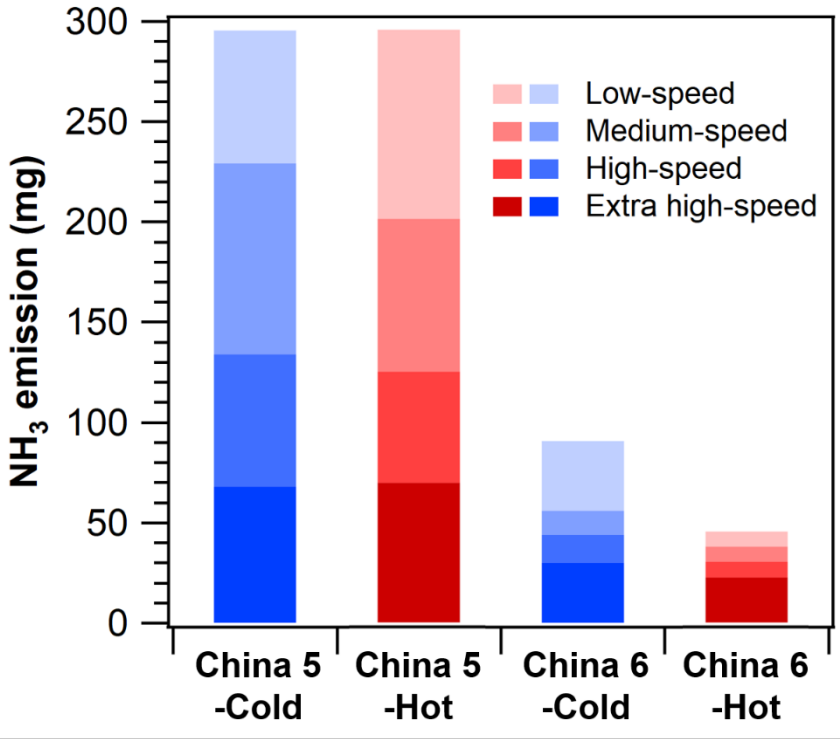

Fig. S2 NH_3 emission for LDGVs during WLTC cycle in different speed phases.

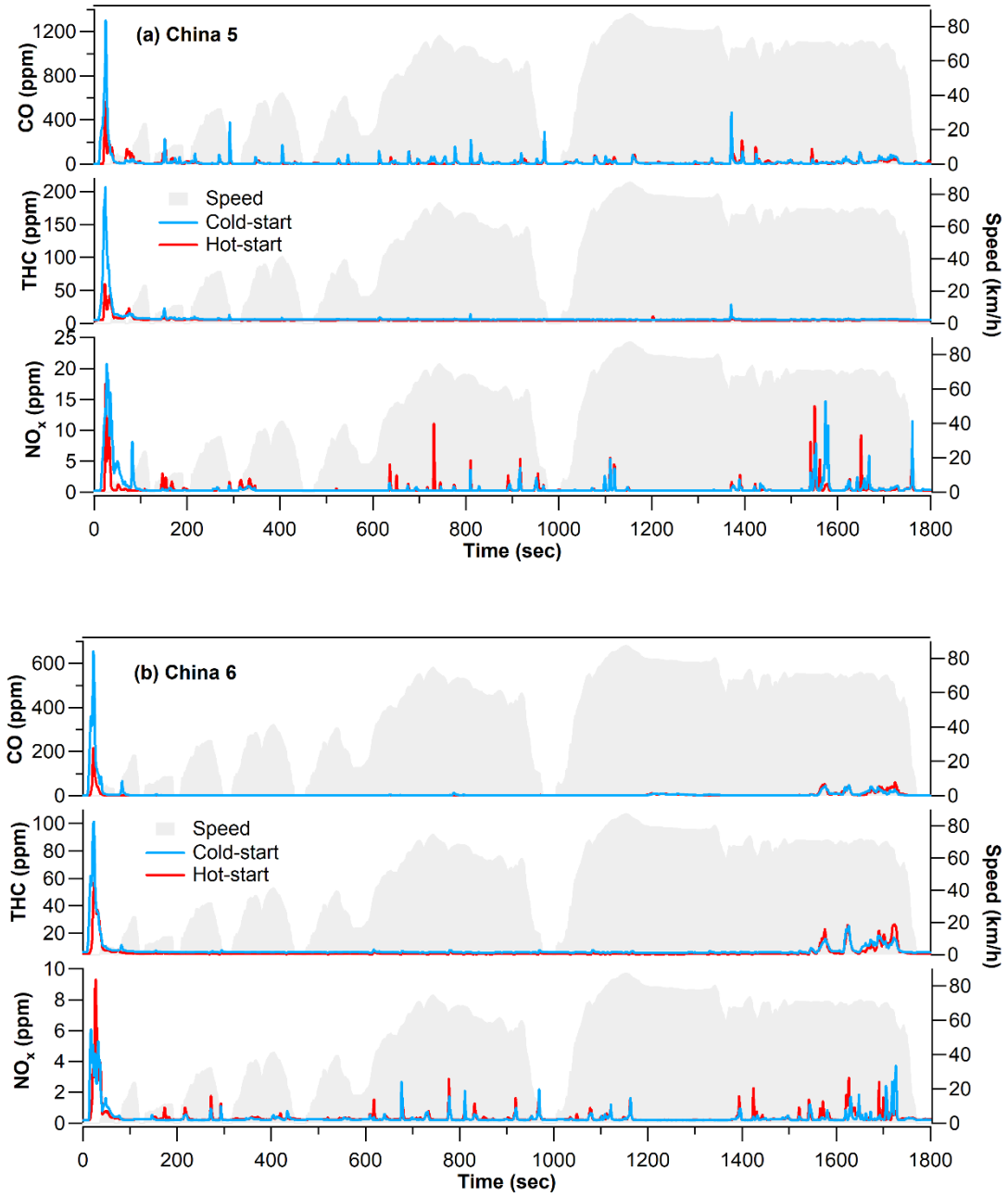

Fig. S3 Instantaneous CO, THC and NO_x concentrations in the CVS for (a) China 5 and (b) China 6 LDGVs under cold- and hot-start conditions.

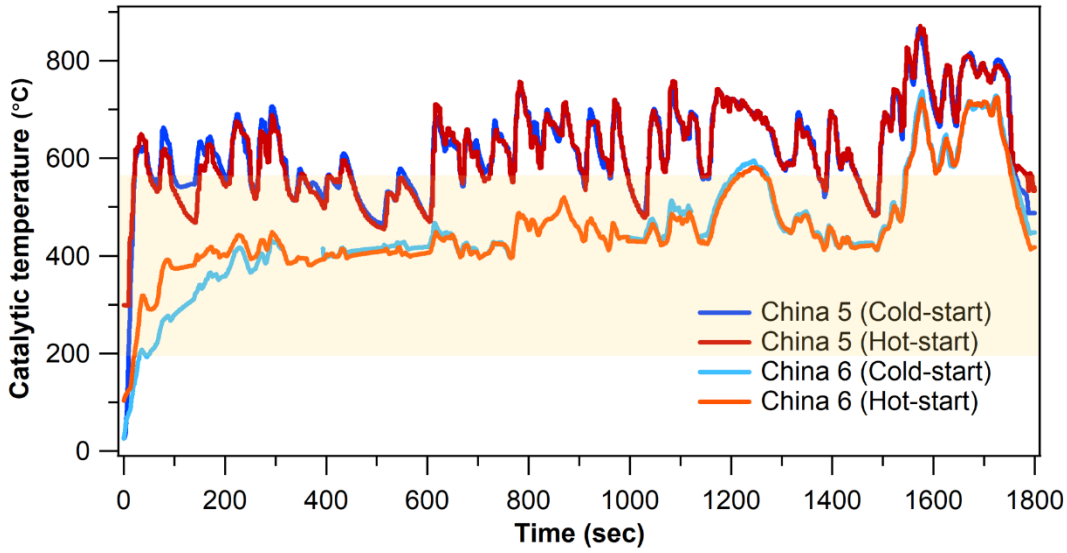

Fig. S4 Catalytic temperature variations during the WLTC cycle under cold- and hot-start conditions for China 5 and 6 LDGVs. Yellow shaded area marked the temperature range of 200℃–550℃.

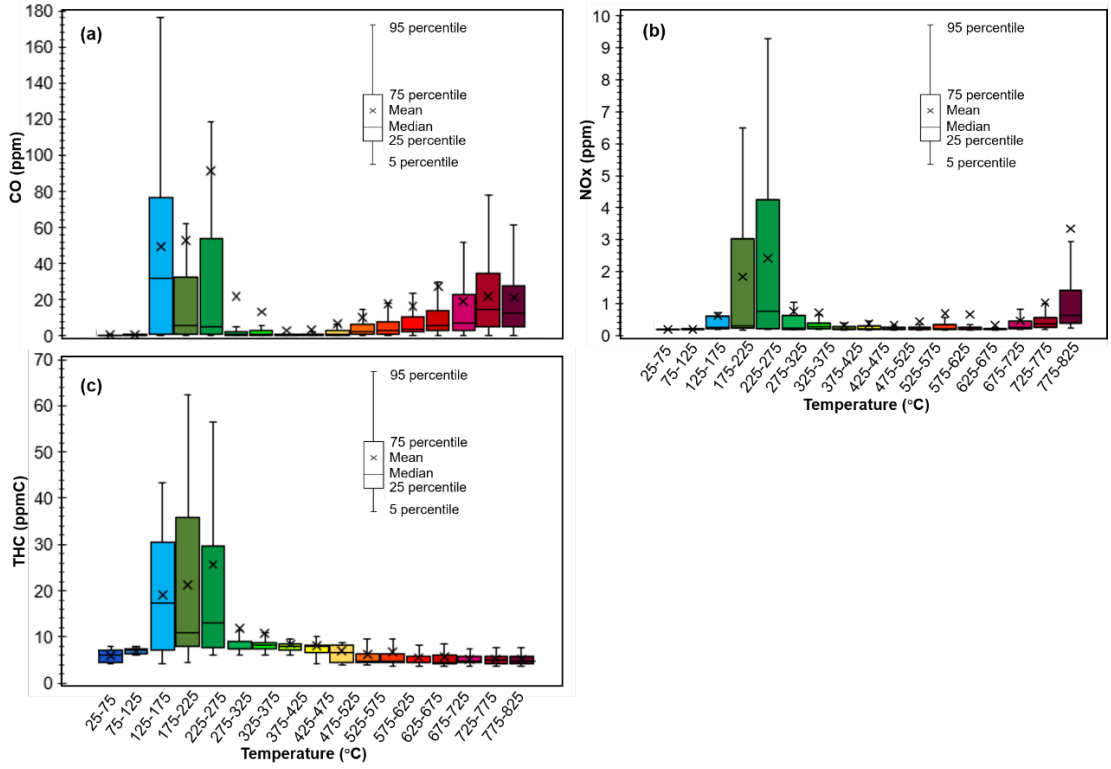

Fig. S5 (a) CO, (b) NO_x and (c) THC emissions (measured in the CVS) within different ranges of catalytic temperature.

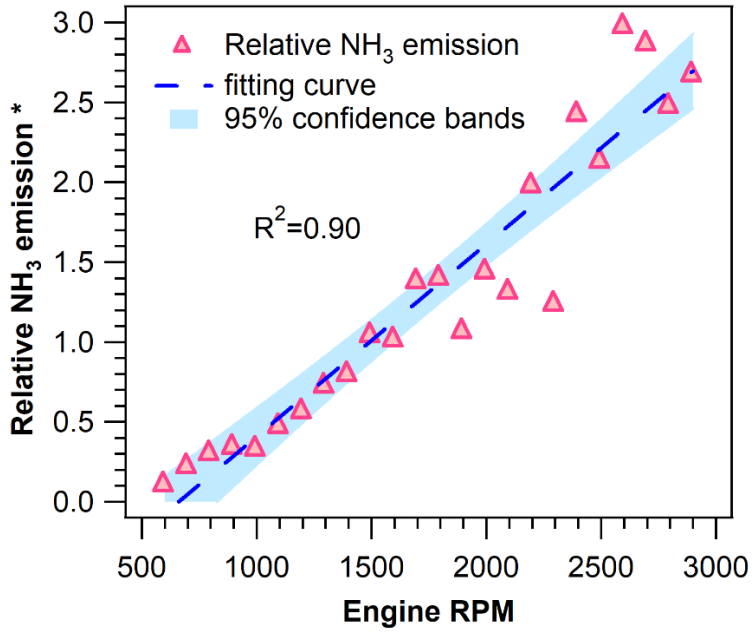

Fig. S6 Correlation between relative NH_3 emission and engine RPM for tested LDGVs. Sampling points for RPM above 2900 accounted for less than 4% of total so was merged as 2900 r/min. (*Relative NH_3 emission is a nondimensional factor that achieved by dividing instantaneous NH_3 emission rate by average NH_3 emission rate for the entire cycle.)

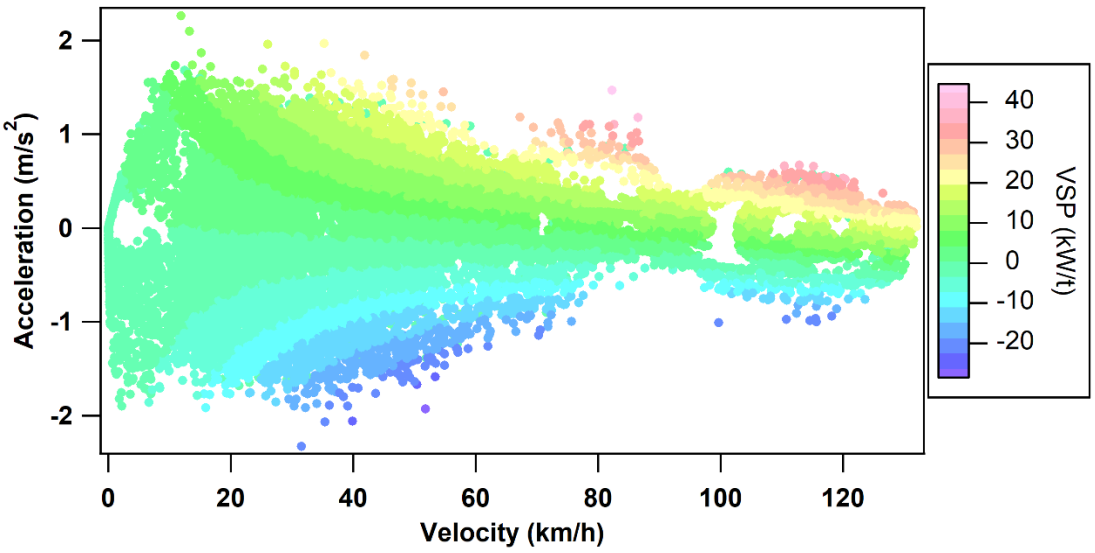

Fig. S7 VSP value against vehicle velocity and acceleration.

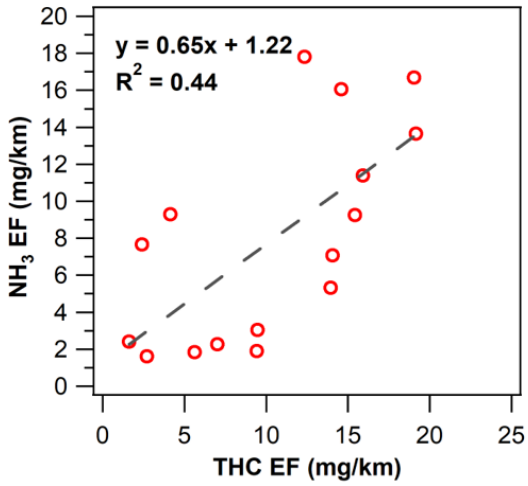

Fig. S8 NH_3 EFs against THC EFs for LDGVs.

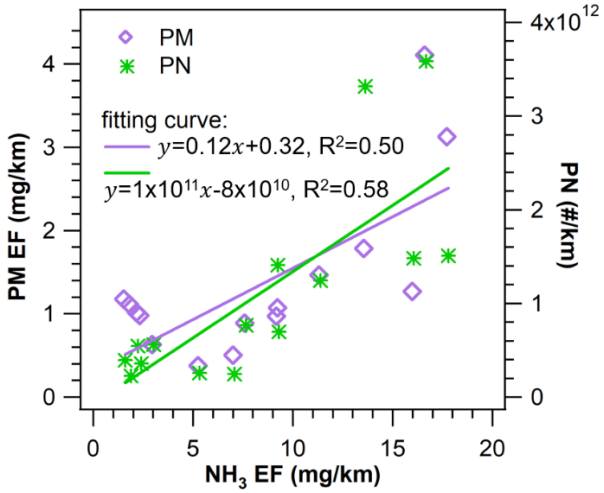

Fig. S9 Correlations between EFs for NH_3, PM and PN.

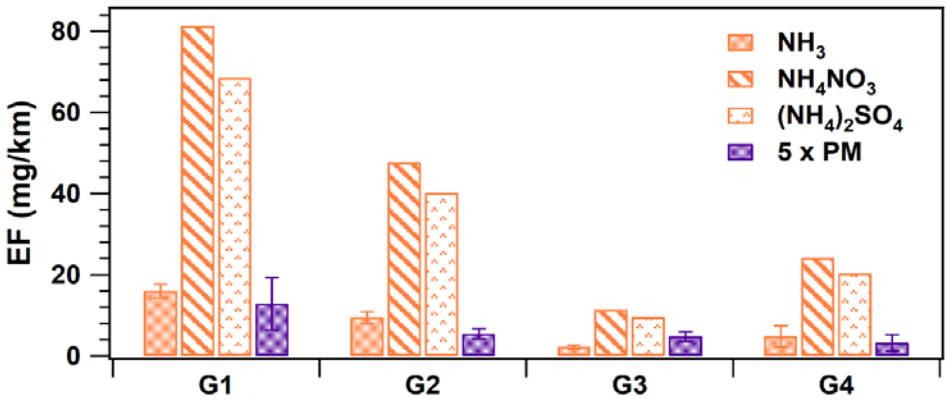

Fig. S10 EFs for NH_3 and ammonium salts converted from NH_3 compared to primary PM emissions.