Supplementary Information

Investigating the vital influences of multi-factor synergies on the nitrate formations on the surface of nano MgO particles

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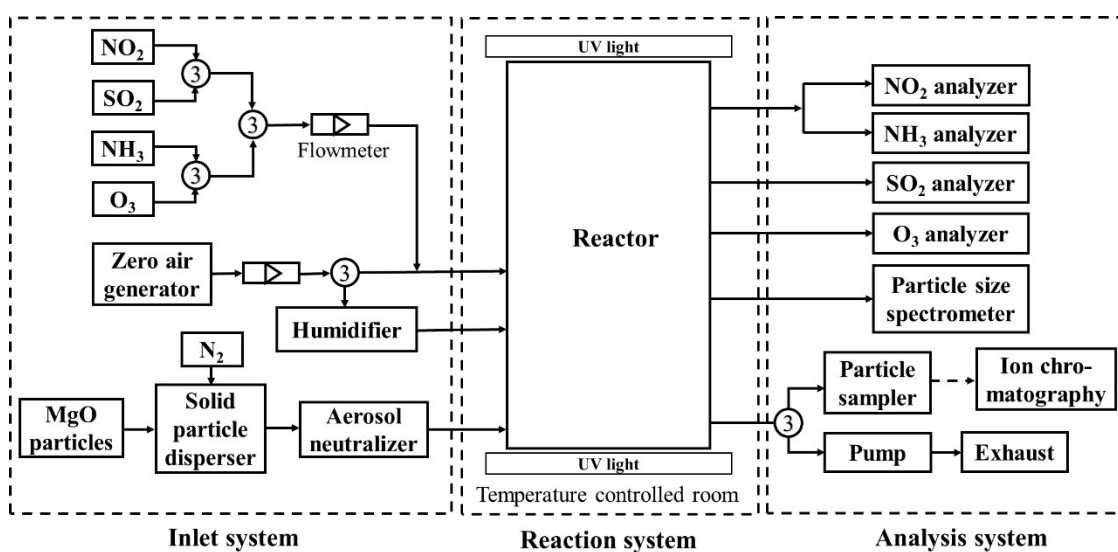Correspondence to L. H. Han (hlh@bjut.edu.cn)

Fig.S1 Schematic of smog chamber set up at BJUT, 3: three-way valve; ▷ : flowmeter.

Table S1 Characteristics of instruments used in the smog chamber experiments

Instrument	Producer and Model	Functions	Performance Index
Zero-air generator	Thermo Fisher Science, Model-111	Provides zero air	Maximum flow 20L/min; HC <0.1ppm; NO<0.5 ppb; NO_2 <0.5ppb; O_3 <0.8ppb; SO_2 <0.5ppb; NH_3 <0.5ppb; RH<5%; PM<1 cm^{-3}
O_3 generator	Thermo Fisher Scientific, Model-49i IPS	Provides O_3	Flow: 4L/min; Range of 0-1000ppb
Solid particle Disperser	PALAS, RBG-1000	Produces dry nanoscale particles	Particle generation rate of 616mg/h
Aerosol neutralizer	SIMCO, Model-6110A	Neutralize electrical properties of particles	Dissipation time < 4 seconds Ion balance < ± 25V
SO_2 analyzer	Thermo Fisher Scientific, Model-43i	Determinate concentration of SO_2	Detection range 0-50ppm; Accuracy of ±1.0ppb
NO-NO_2-NO_x analyzer	Thermo Fisher Scientific, Model-42i	Determinate concentration of NO-NO_2-NOx	Detection range 0-50ppm; Accuracy of ±1.0ppb
O_3 analyzer	Thermo Fisher Scientific, Model-49i	Determinate concentration of O_3	Detection range 0-50ppm; Accuracy of ±1.0ppb
NH_3 analyzer	Thermo Fisher Scientific, Model-17i	Determinate concentration of NH_3	Detection range 0-50ppm; Accuracy of ±1.0ppb
Multi-Gas Calibrator	Thermo Fisher Scientific, Model-146i	Calibration gas analyzer	Provides accurate concentrations of SO_2, NO_2 and NH_3 or other gases
Particle size spectrometer	TOPAS, Model LAP322	Measure the size distribution of PM	Detection range of 200nm-5μm
Particle sampler	MSP, Model 125R NanoMoudi-ⅡTM	Membrane sampling PM	Collect PM in 13 levels
Ion chromatography	Dionex™ ICS-2100; Thermo Fisher Scientific, Aquion™	Measurement of water soluble anions and cations	Digital signal range: 0 to 15000 μS

Table S2 The initial conditions of NO_2 heterogeneous reactions on the surface of nano MgO aerosol particles in the different reaction systems in this study period

Exp. No.	Reaction System	React time (min)	Initial reaction conditions							
			NO_2 (ppb)	MgO Particle ($\mu g\ m^{-3}$)	T (°C)	RH (%)	Lamp (number)	O_3 (ppb)	NH_3 (ppb)	SO_2 (ppb)
1		300	320.66	365.94	20.0°C	17.8%				
2		300	305.65	346.62	22.4°C	38.1%		51.54		
3		300	312.61	359.92	25.7°C	36.6%		91.12		
4		300	320.37	350.59	21.7°C	30.1%		190.47		
5		300	320.65	372.51	20.9°C	33.3%			104.35	
6		300	322.32	389.88	21.3°C	32.0%			173.05	
7		300	321.27	386.96	22.8°C	33.6%			327.11	
8	NO_2-MgO-Dark	300	338.23	384.69	20.2°C	28.9%				78.70
9	(Night)	300	332.83	364.47	21.3°C	32.9%				167.10
10		300	331.09	385.04	23.3°C	30.2%				281.66
11		300	330.50	392.85	22.1°C	24.4%		92.91	74.98	
12		300	327.19	386.08	21.6°C	22.0%		100.71	249.19	
13		300	327.49	372.41	20.4°C	22.7%		107.86	334.25	
14		300	321.82	378.22	22.7°C	23.5%		93.20		86.64
15		300	333.18	381.40	21.7°C	26.4%		92.39		188.47
16		300	324.29	372.12	22.3°C	25.6%		95.04		288.21
17		300	328.44	366.08	19.5°C	20.6%	20			
18		300	312.69	366.98	16.6°C	34.4%	40			
19		300	326.10	362.52	30.7°C	25.5%	40	94.73		
20		300	328.97	354.82	32.6°C	26.9%	40	169.74		
21	NO_2-MgO-hv	300	348.77	362.64	30.8°C	26.3%	40	286.22		
22	(Day)	300	330.42	383.90	21.2°C	29.7%	40		128.92	
23		300	331.74	373.02	19.9°C	22.0%	40		211.37	
24		300	346.82	379.62	19.7°C	25.7%	40		317.60	
25		300	339.47	373.65	20.3°C	26.5%	40			75.52
26		300	333.62	388.86	19.1°C	22.0%	40			160.52
27		300	333.30	398.52	19.2°C	23.4%	40			260.86