Supporting Information

Gas-phase chemiluminescence of reactive negative ions evolved through corona discharge in air and O_2 atmospheres

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Experimental Section

Chemical Reagents.

O_2 used in this research were of high-purity grade (99.999%) from Ru Yuan Ru Quan Co (Beijing, China). Synthetic air (78% N_2, 21% O_2, 0.04% CO_2 and 0.96% Ar) was purchased from Haipu Co (Beijing, China). 2,2,6,6-Tetramethyl-4-piperidine (TEMP) was obtained from Sigma-Aldrich (St. Louis, MO, USA). Wahaha purfied water was used throughout the experiment. All reagents used in this experiment were without further purification.

Instrumentations.

Negative ions producer was bought from Sun You Co (Japan). Gas flowmeter was bought from Jin Dian Co (Zhejiang, China). Tube material: glass, inner diameter of the tube used for the cell: 1 cm, outer diameter of the tube used for the cell: 1.2 cm, lengths between the corona discharge inlet and the elbow: 5 cm, lengths between the elbow and the optical detection center: 4.5 cm. Voltage regulator was purchased from Long Wei Co (Hongkong, China). Negative ions calculator (COM-3200PRO) was bought from COM Co, Japan. Ozone generator was purchased from Mfresh Co, China.

Characterization

The CL kinetics curve was carried out with a BPCL ultra-weak CL analyser (Institute of Biophysics, Chinese Academy of Science, Beijing, China), PMT (GDB52) was produced from CNNC beijing nuclear instrument factory. The high voltage was 1.2 kV. The signal was recorded by a computer with a data-acquisition interface. Data acquisition and treatment were performed with BPCL software. ESR spectra were measured on a Bruker spectrometer (ESP-300 E, Bruker, Germany). Mass spectra were obtained from chromaster-5610 (Hitachi, Japan).

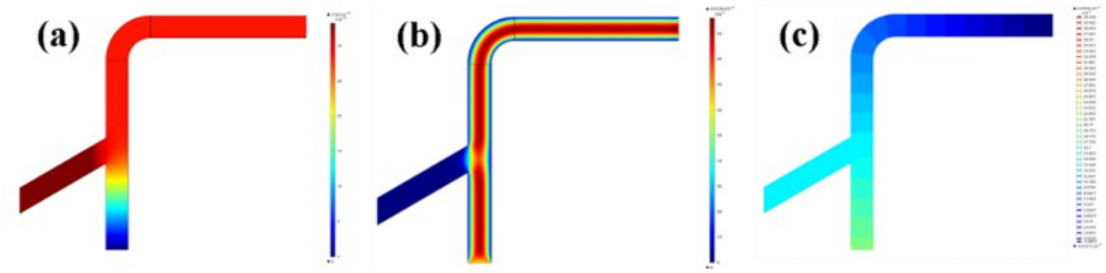

Fig. S1 Simulations of (a) ion concentration, (b) gas flow rate and (c) pressure inside the tube. Gas: air, gas flow rate: 50 ml/min, voltage: -2 KV, negative ions concentration: $2\times10^{8}/cm^{3}$ (inlet) and $2\times10^{5}/cm^{3}$ (outlet), temperature: 22°C.

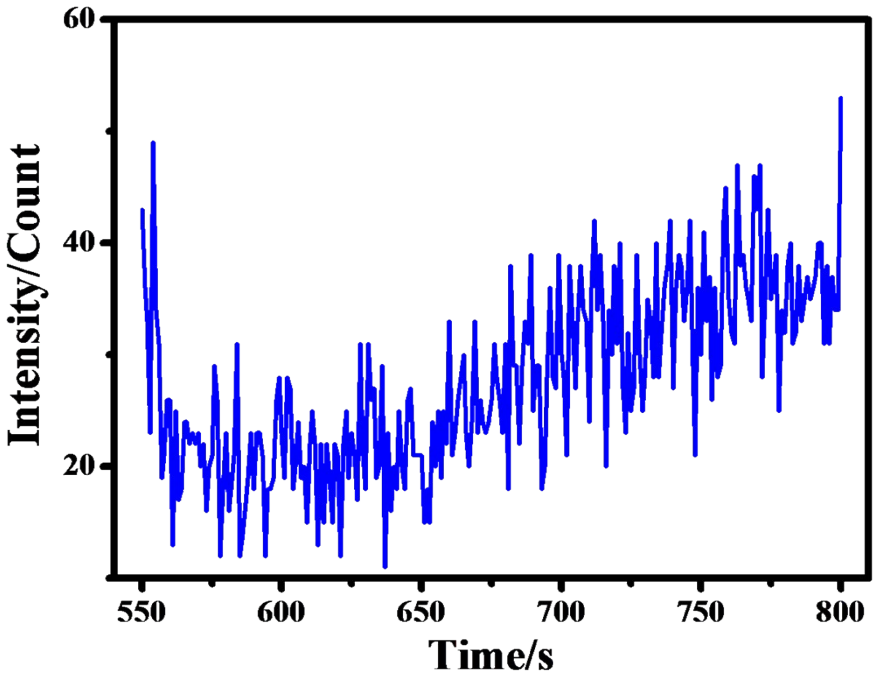

Fig. S2 Relevant CL spectrum between 550 and 800 s of Fig. 2b with both gas flow and corona discharge were shut down. Gas: air, gas flow rate: 50 ml/min, voltage: -2 KV, negative ions concentration: $2\times10^{5}/cm^{3}$.

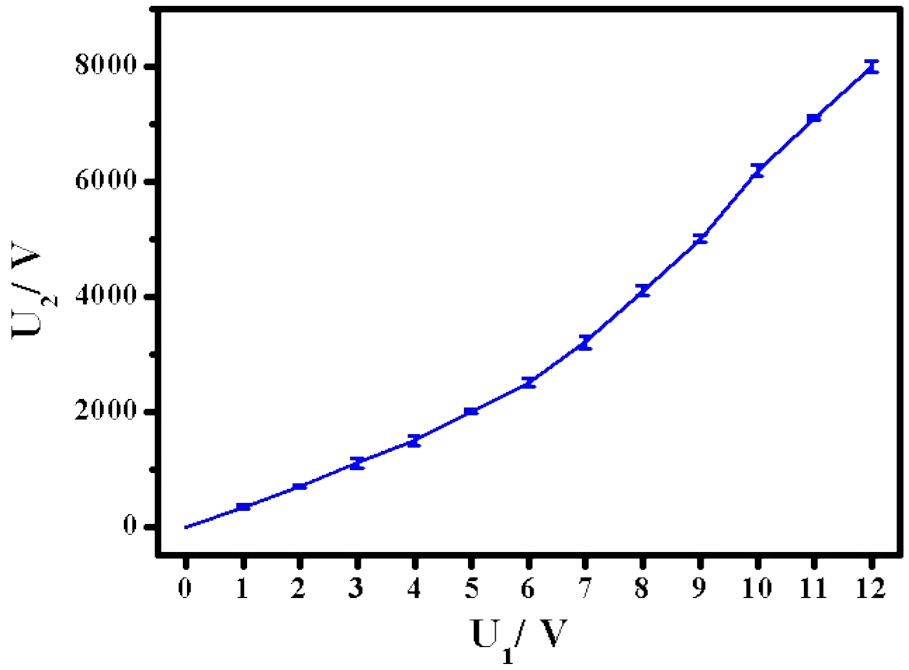

Fig. S3 Relationship between values set by regulator (U_1) and voltage of negative ion generator tip (U_2). Gas: air, gas flow rate: 0 ml/min.

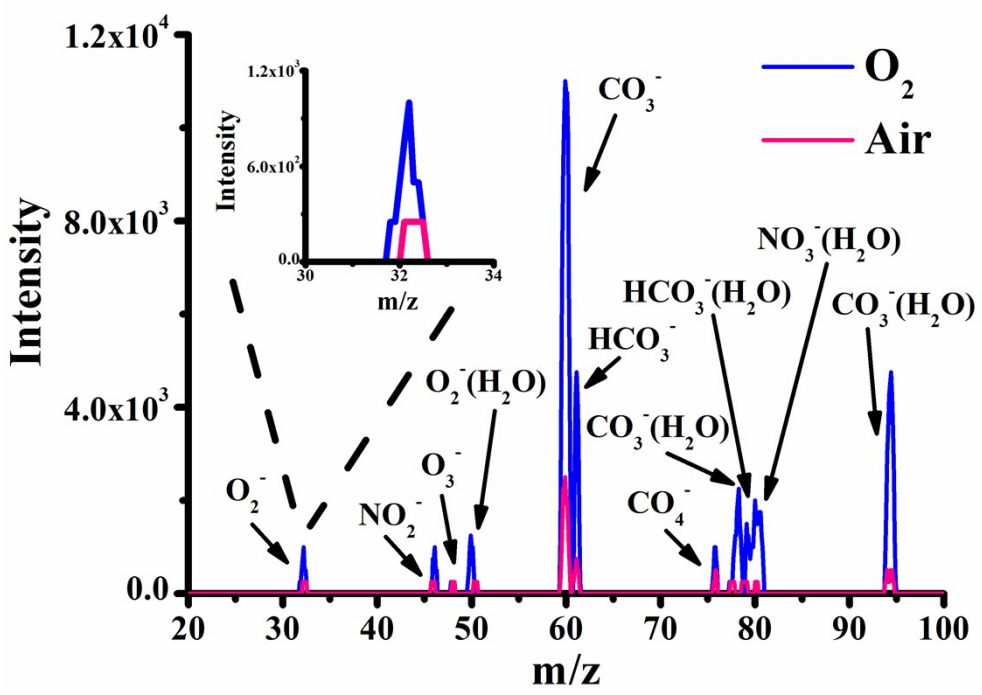

Fig. S4 Relevant MS spectrum of negative ions evolved through corona discharge in air and oxygen atmospheres. Gas flow rate: 50 ml/min, voltage: -2 KV, negative ions concentration: air: $2\times10^5/cm^3$, O_2: $7\times10^5/cm^3$.

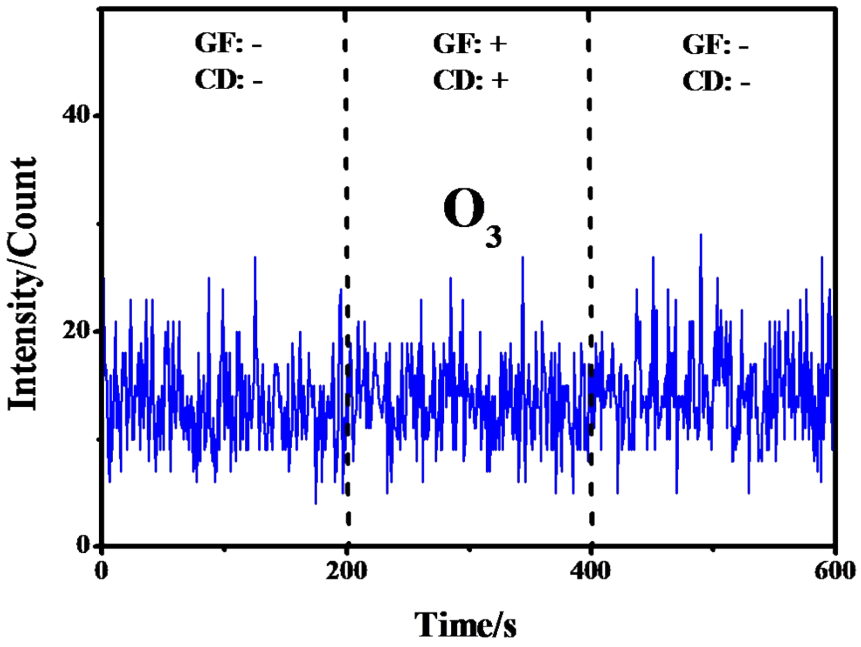

Fig. S5 Relevant CL curves of negative ions produced in O_3 with gas flow and corona discharge being present and absent simultaneously. GF: gas flow; CD: corona discharge. +: leaded in or turned on; -: shut down or turned off. Each part lasted 200 s. Gas flow rate: 10 L/min, voltage: -2 KV, negative ions concentration: 150/cm^3.