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Supporting Information for

# Effects of a Nanoceria Fuel Additive on Physicochemical Properties of Diesel Exhaust Particles

Junfeng (Jim) Zhang<sup>a,\*</sup>, Ki-Bum Lee<sup>b</sup>, Linchen He<sup>a</sup>, Joanna Seiffert<sup>c</sup>, Prasad Subramaniam<sup>b</sup>, Letao Yang<sup>b</sup>, Shu Chen<sup>c</sup>, Pierce Maguire<sup>c</sup>, Gediminas Mainelis<sup>d</sup>, Stephan Schwander<sup>e</sup>, Teresa Tetley<sup>c</sup>, Alexandra Porter<sup>c</sup>, Mary Ryan<sup>f</sup>, Milo Shaffer<sup>f</sup>, Sheng Hu<sup>f</sup>, Jicheng Gong<sup>a</sup> and Kian Fan Chung<sup>c</sup>

<sup>a</sup> Nicholas School of the Environment, and Duke Global Health Institute, Duke University, Durham, NC

<sup>b</sup> Department of Chemistry and Chemical Biology, Rutgers University, Piscataway, NJ

° National Heart and Lung Institute, Imperial College London, London, UK

<sup>d</sup> Department of Environmental Sciences, Rutgers University, Piscataway, NJ

<sup>e</sup> School of Public Health, Rutgers University, Piscataway, NJ

<sup>f</sup> Department of Materials and London Centre for Nanotechnology, Imperial College London, London, UK

\*Address all correspondence to Prof. J. Zhang, 919-681-7782, email: junfeng.zhang@duke.edu

#### Table S1.

ICP-MS operating parameters.

Torch	VG quartz		
Nebulizer	Concentric		
RF power	1350W		
Reflected Power	Zero		
Sample delivery rate	0.8 mL/sec		
Sample cone	1.0-mm orifice		
Skimmer	0.7-mm orifice		
Dwell time	320 msec/1000 msec		
Acquire time	1 min/4 min		
Cooling argon gas	14L/min		
Auxiliary argon gas	0.88 L/min		
Nebulizer argon gas	0.73 L/min		

#### **Sonication protocol**

Two sonication powers, 50W and 100W, were used to extract DEPs from filter into solution. 50W sonication for different time did not provide stable results (Figure S1). There were no significant differences in average sizes after sonication for longest time (100 hours) and shortest time (2 hours). Even for the longest sonication time, the particles' average size (171.6 nm) was still higher than the airborne particles' size (157.6 $\pm$ 16.4 nm) size, which represent the particles contained in dilution air. Therefore, it is necessary to increase the power of sonicator in order to increase the sonication efficiency and improve its performance.



**Figure S1.** Average size by number (nm) of Diesel Exhaust Particle (DEP) extracted by sonication (50W) for different time under.

Sonication power (100W) was further applied and DEP sizes and particle extraction efficiency at this condition are presented in Table S1 and S2, respectively. The results show that, 2 hours were a good time span for sonication, because particle size after sonication was stable and already below the airborne particle size. Moreover, acceptable particle extraction efficiencies were acquired by using 100W/2 hour sonication protocol, which is used as the particle extraction protocol for this study.

## Table S2.

Average diameters by number of particles extracted by sonication (100W) for different times (0.5, 1, 2 hours).

Sonication time (hour)	Average Diameter by Number (nm)				
	Repeat A	Repeat B	Average size		
0.5	243.9	207.3	225.6		
1	154.8	148	151.4		
2	132.5	132.8	132.65		

### Table S3.

Particle extraction efficiency under different sonication parameters.

	2 hours/100 W (%)			
0x	93.49(±2.98)			
0.1x	93.92(±1.72)			
1x	93.45(±1.98)			
10x	94.88(±0.90)			
Total Average	93.93(±1.92)			

# **DEP** Components Verification



#### Table S4

Interplanar spacings of cubic cerium oxide. Reference: Natl. Bur. Stand. (U.S.) Monogr. 25, 20, 38, (1983).

Name and formula		Crystallographic parameters						
Reference code	ference code 00-034-0394		Crystal system		Cubic	Cubic		
Name	me Cerium Oxide/Ceria		ia	Space group		Fm3m	Fm3m	
Chemical form	ula	CeO <sub>2</sub>		Space group number		225	225	
Peak list								
No.	h	k	1		d[A]	2Theta[deg]	I [%]	
1	1	1	1		3.12344	28.555	100	
2	2	0	0		2.70564	33.082	30	
3	2	2	0		1.91341	47.479	52	
4	3	1	1		1.63181	56.335	42	

Lattice spacings shown in **Figure S2** of  $0.310\pm0.009$ ,  $0.314\pm0.009$  and  $0.270\pm0.008$  nm correspond to the (111) and (200) interplanar spacings of cubic cerium oxide (0.312 and 0.271 nm), respectively (**Table S3**). Findings show that the cerium content mixed with DEPs exists in the form of CeO<sub>2</sub>.