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www.elsevier.com/locate/jaerosci

PII: S0021-8502(16)30334-2
DOI: http://dx.doi.org/10.1016/j.jaerosci.2017.01.004
Reference: AS5095

To appear in: *Journal of Aerosol Science*

Received date: 30 September 2016
Revised date: 14 January 2017
Accepted date: 16 January 2017

Cite this article as: Runlong Cai, Da-Ren Chen, Jiming Hao and Jingkun Jiang, A Miniature Cylindrical Differential Mobility Analyzer for sub-3 nm Particle Sizing, *Journal of Aerosol Science* http://dx.doi.org/10.1016/j.jaerosci.2017.01.004

A Miniature Cylindrical Differential Mobility Analyzer for sub-3 nm Particle Sizing

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Abstract

Effective particle sizing is one of the limitations in measuring sub-3 nm aerosol. In this study we developed a miniature cylindrical differential mobility analyzer (mini-cyDMA) for sub-3 nm particle sizing. The construction of the miniature cylindrical DMA, stemmed from the cost-effective DMA (cDMA) developed by Mei et al. (2011), enables it to be operated at higher sheath flowrate than the cDMA. To keep the sheath flow laminar in the DMA classification region for the flowrate up to 30 liters per minute (lpm) for better matching the flowrate required by the aerosol detector while having a good sizing resolution, the DMA components such as the inlet for sheath flow, nylon screen for flow laminarization, and the chambers for polydisperse aerosol flow inlet and excess flow exit were re-designed in the mini-cyDMA. Transfer function of the mini- cyDMA was evaluated using tetra-alkyl ammonium cations with electrical mobility diameters of 1.16 nm, 1.47 nm and 1.78