

AN ENGINE EXHAUST PARTICLE SIZER FOR TRANSIENT EMISSION PARTICLE MEASUREMENTS

Tim Johnson, Rob Caldow, and Arndt Pöcher

TSI Incorporated

Aadu Mirme

University of Tartu

David Kittelson

University of Minnesota

ABSTRACT

The measurement of particle emissions from vehicles has been a compromise based on which parameters were most important for the particular measurement. There has been increased interest in obtaining size-distribution data during transient engine operation where total number concentrations can change dramatically. For measuring submicrometer particle sizes, currently the most common technique, scanning mobility particle sizer (SMPS), relies on electrical mobility. The SMPS gives high size resolution but requires an aerosol to be stable with time to make a particle-size distribution measurement.

This paper describes a new instrument, the engine exhaust particle sizer (EEPS), which has high time resolution, uses electrical mobility for classifying the

particles, and was designed specifically for measuring engine exhaust. The measurement is based on the particles' electrical mobility similar to what is used in the SMPS system.

Particles entering the instrument are charged to a known charge level. The particles then are repelled outward by the voltage from a central column. When the particles reach an outer cylindrical (a column of rings), they create a current on one of the rings that is measured by an electrometer. The electrometer currents are measured multiple times per second to give high time resolution.