

## **Key Parameters Affecting Diesel Particulate Filter Performance Degradation and Impact on Lifetime Fuel Economy**

### **Abstract**

The high efficiency of Diesel Particulate Filters (DPFs) makes them an excellent choice to eliminate the particulate matter emissions from modern Diesel engines. However, the accumulation of ash in DPFs adversely affects engine efficiency, limits the DPF's in-use service life, and imposes additional maintenance requirements on end-users. At MIT (Sloan Automotive Laboratory), the parameters of ash accumulation in DPFs, including:

- lubricant additive chemistry,
  - filter material and design,
  - engine operation and exhaust conditions, and
  - DPF regeneration strategy,
- are being studied, in an effort to optimize the design of the combined engine-aftertreatment-lubricant system for future diesel engines.

This presentation summarizes the latest findings on the impact of specific parameters affecting ash-related DPF performance degradation. The results of our research identify:

- the specific oil additive components with the largest impact on ash-related pressure drop,
- the relative insensitivity of DPF design (porosity, pore size, material) to ash accumulation, and
- the profound effect of exhaust temperature and regeneration conditions on ash packing and distribution.

Results of application of advanced diagnostics, including in situ optical techniques and electron microscopy, to quantify differences in ash properties and morphology, are also presented.

These results enhance the fundamental understanding to mitigate the ash problem. Also, from a practical standpoint, the information is useful in improving lifetime fuel economy impact of the DPF, and in developing strategies to minimize fuel consumption, while enhancing DPF's performance and extending DPF's service life.