An Experimental Study of PM Emission Characteristics of Commercial Diesel Engine with Urea-SCR System

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Abstract

Background
- Diesel engine: excellent fuel economy benefit, “Fun-to-Drive” High Torque
- But, the regulation of emission: PM, NOx, CO, various Aftertreatment system
- NOx: Utilization of SCR system using urea solution as a reductant

Experiment
1. the experiment of a diesel engine equipped with Urea SCR system, and its emission characteristics including particle is analyzed and evaluated against its regulation.
2. Measurement of PM: Diluter + Thermodenuder + ELPI under various conditions of engine RPM and load (Particle number distribution of size range from 0.5 to 150nm)

Results
1. The particle number was increased in the proportion of amount of urea injection
2. The increase of Fine particle range(<2.5μm) was remarkable
3. The effect of thermodenuder and engine exhaust temperature(250°C~450°C) is almost negligible for the change of particle number distribution tendency
4. But increase of injection pressure (1bar~4bar) of Urea solution:
   - Fine particle (~1μm): Decrease of number of particles White
   - Ultra Fine particle(~10nm) and Nano particles(50nm): Increasing tendency
5. This particles: include new complex matter from urea decomposition process on SCR catalysts and most dry-Urea @ FTIR, TGA/DSC, TEM.

Conclusions

Undesirable particles come from Urea-SCR :
- Ammonium Sulfate, Ammonium Nitrate, New polymer Complex(by HNCO base), etc.

Weight and Number of PM deeply depend on the Urea injection strategy & Urea Injection System Design

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