Diesel Aftertreatment Accelerated Aging Cycle

SwRI Symposium

02/22/2008

LNT Durability with In-cylinder Rich Combustion without Post Injection

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PRESENTATION OUTLINE

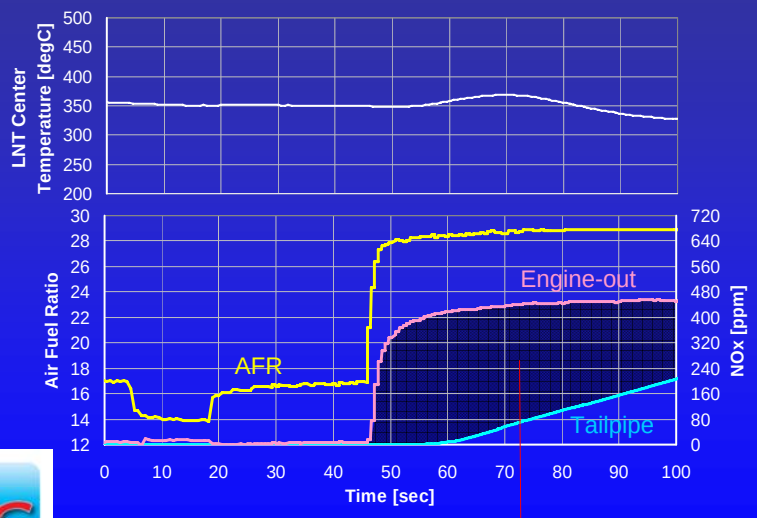
- Introduction
- Definition of NOx Adsorbent Capacity
- Accelerated Aging Calculation
- Benefit of In-Cylinder Rich Combustion
  - High engine-out CO, H_2 low HC
  - LNT temperature control during de-SOx with in-cylinder rich combustion
- LNT Durability Test Results
- Engine Aged and Sulfur Loaded vs. Oven-Aged

INTRODUCTION

- **The Work Described Considered**
  - **LNT deactivation measurement using NOx adsorbent capacity**
  - **On engine method for LNT accelerated aging**
    - **calculation of number of DeSOx event**
  - **Approach for LNT Desulfation (DeSOx)**
  - **Results of aging on LNT performance**
  - **Comparison of full aging procedure versus oven aging without any sulfur exposure (pure thermal)**

3

Definition of NOx Adsorbent Capacity



NOx adsorbent capacity = NOx g / Catalyst vol L

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4

Accelerated Aging with High Sulfur Fuel

- Number of De-SOx Events Over 120,000 Miles
  - Depends on vehicle fuel economy, desired maximum sulfur loading, fuel sulfur level, catalyst volume

Mileage between DeSOx = Avg Fuel Economy (mpg) x Fuel Consumed (gal)

Fuel Consumed = Desired S Loading (g/L) * Cat_vol (L) / Fuel S (g/gal)

For 15ppm S fuel with 0.831 SG, the Fuel S (g/gal) = 47.2 mg S/gal

Example

Avg Fuel Economy [mpg]	Des S Loading [g/L]	Cat vol [L]	Fuel Consumed [gal]	Mileage between DeSOx [mi]	No. of DeSOx Events over 120k miles
35	1.0	1.5	31.8	1112	108

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5

High Engine-out CO, H_2 and Low HC by Rich Combustion

High CO, H_2 (Low HC)
⇒ High NOx η, low Fuel Penalty

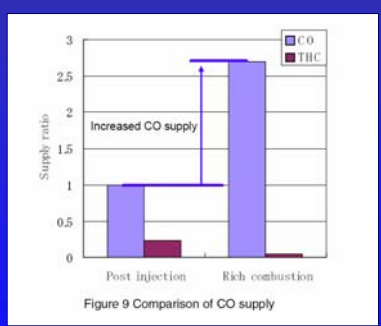
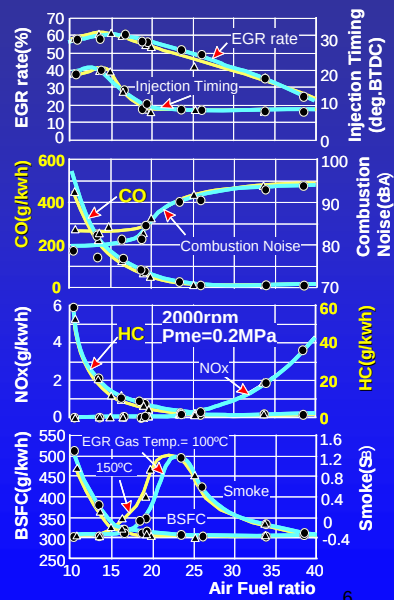


Figure 9 Comparison of CO supply

SAE 2007-01-0239; Honda



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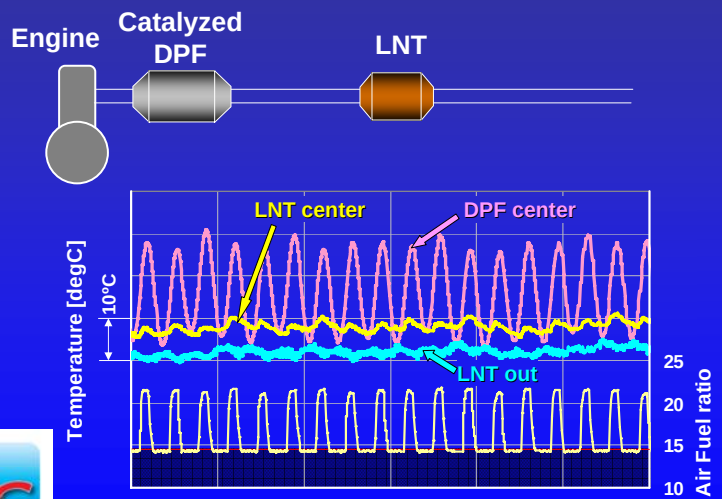
6

LNT Temperature (Precise) Control



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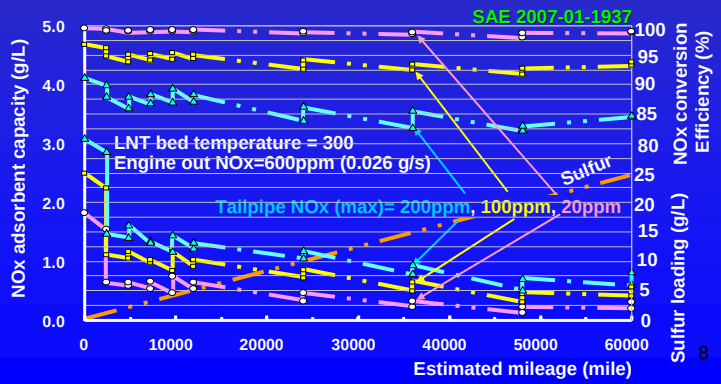
7

LNT Engine-aging Results

- Gasoline Mass Production LNT, High Sulfur Fuel (430ppm)
  - With rich combustion, without post injection
  - Mileage is estimated from sulfur loading/De-SOx cycles
  - Desulfation was performed when sulfur loading became 1g/L

Small exotherm with no post inj. underfloor LNT

Some NOx adsorbent capacity remained



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8

Effect of Aging Condition on NOx Adsorbent Capacity

- When Temperature is Controlled Precisely, Sulfur-Free Oven Aged is Very Similar to Engine Aged

NOx Adsorbent Capacity at 350 °C LNT Temperature

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9