Diesel Aftertreatment Accelerated Aging Cycle

SwRI Symposium

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DOCs AND LNCs

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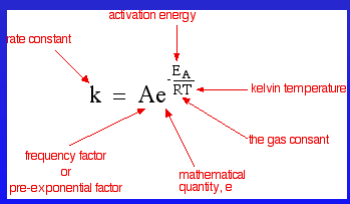
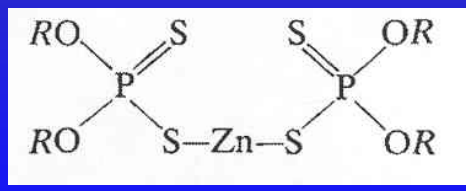
DOC (1)

- **Diesel Oxidation Catalysts (DOC) Serve Multiple Functions in Diesel Exhaust Applications**
  - **HC and CO emissions reduction**
  - **NO_2 generation from NO + O_2 to assist DPF regeneration and LNT and SCR performance**
  - **NH_3 emissions reduction as slip of clean-up catalyst**

DOC (2)

- **DOC Deactivation is Primarily**
  - **Thermal – Arrhenius rate law applies**
  - **Chemical poisoning – e.g. lubricant oil phosphorus**





ZDDP

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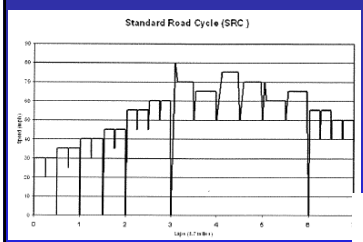
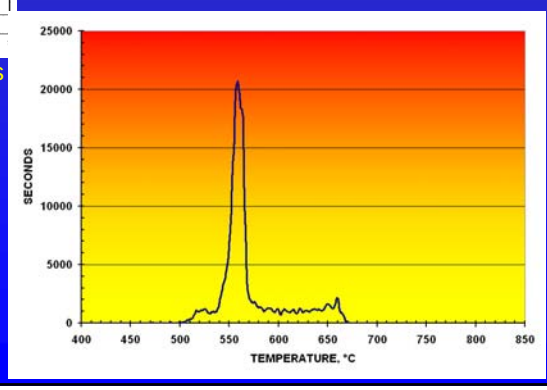
DOC (3)

- **Example of DOC DAAAC Development**



x 4633 cycles = 120,000 miles

- **Drive representative vehicle ~ 4 cycles 104 miles using EPA SRC**
- **Generate temperature histogram adjusted to 120,000 miles**



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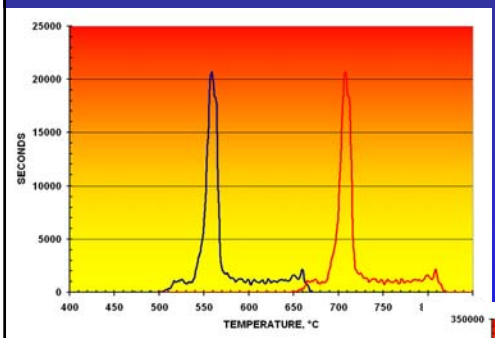
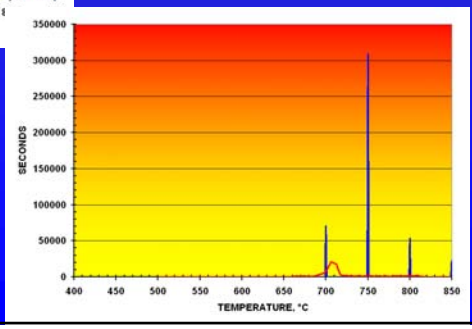
DOC (4)



- Raise temperatures to accelerate aging time

- Create simplified steady-state aging modes for bench engine aging cycle



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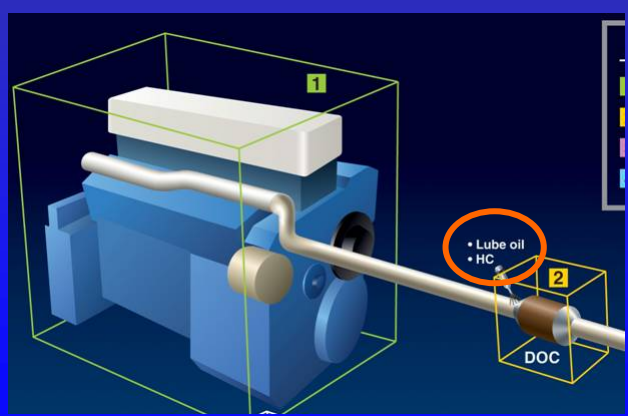
DOC (5)

- Chemical Poisoning Component
  - Use similar method as for other components
    - e.g. oil-in-fuel + in-exhaust injection



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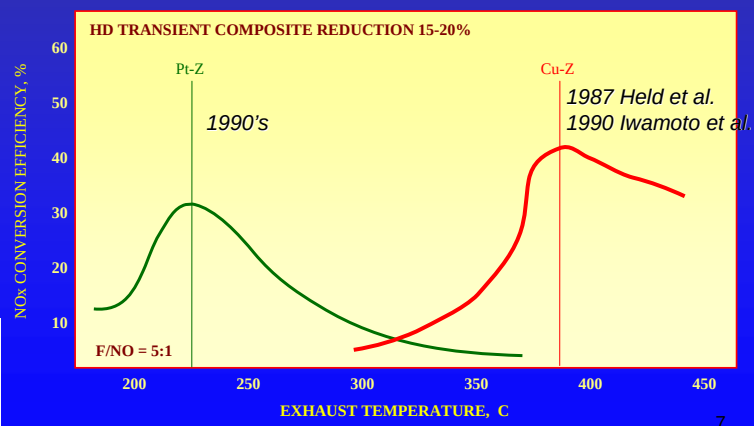
LNC (1)

- Lean NOx Catalysts (LNC) a.k.a. Hydrocarbon Selective Reduction Catalysts (HC-SCR)
  - Convert NOx to N_2 using hydrocarbon as reductant



(COMPOSITE GENERATED FROM INDUSTRY EXPERIENCE)

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LNC (2)

- Deactivation Mechanisms

COPPER
  - Copper dispersion stability at high temperatures

ZEOLITE
  - Hydrothermal durability – dealumination
    - c.f. urea SCR catalysts

- Silver / Alumina LNCs
  - Silver dispersion stability at high temperatures
  - Alumina surface area stability at high temperatures

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LNC (3)

- Cerium / Silver / Zeolite LNCs
  - Cerium and silver dispersion stability at high temps
  - Zeolite hydrothermal durability - dealumination
    - c.f. urea SCR catalysts
- Primary Deactivation is Thermal / Hydrothermal
- Chemical Deactivation ???
  - Similar Procedure to DOC / SCR ???