DELPHI
Automotive Systems

DELPHI ENHANCED NTP EMISSION SOLUTION TESTED ON LIGHT-DUTY VEHICLE

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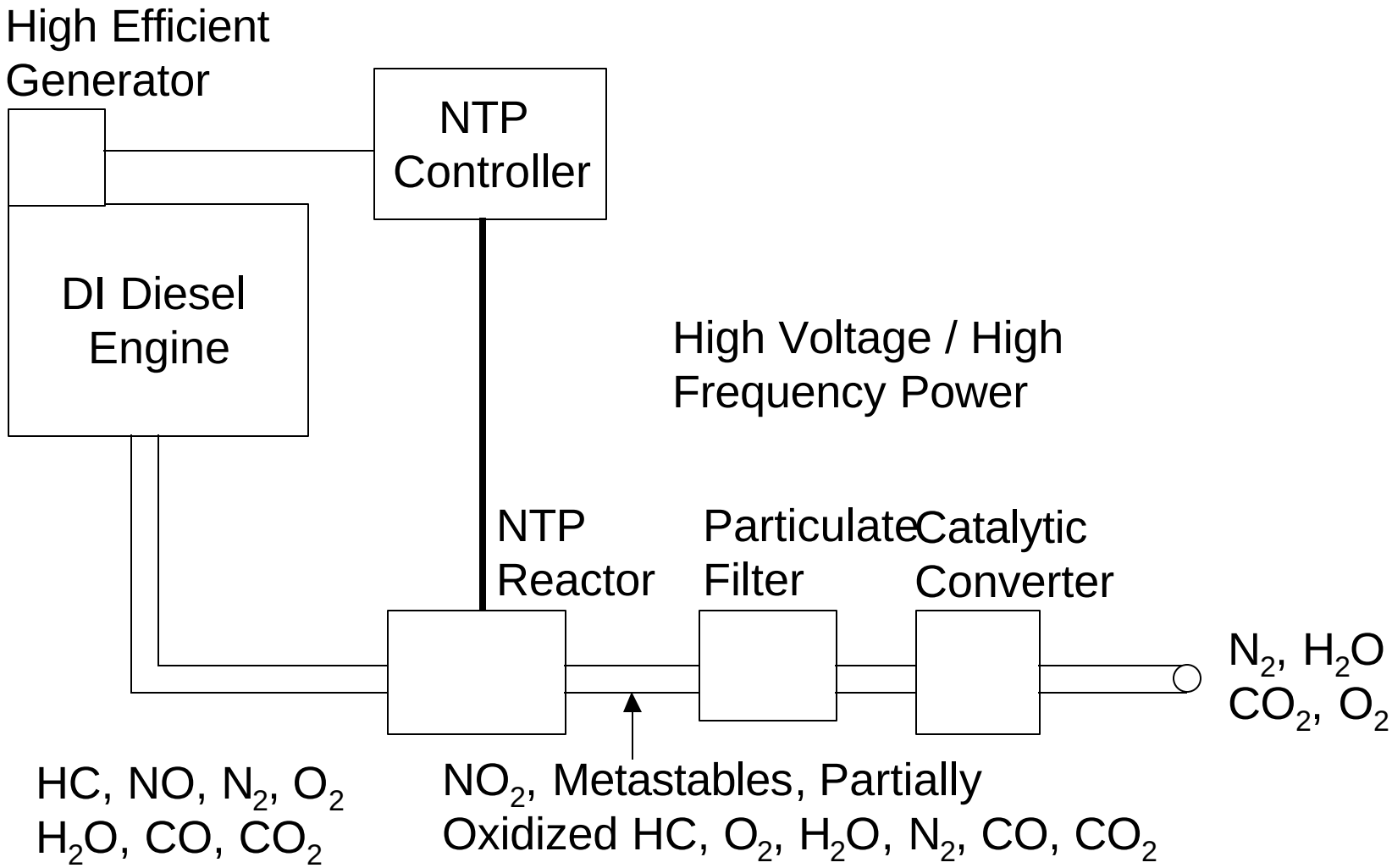
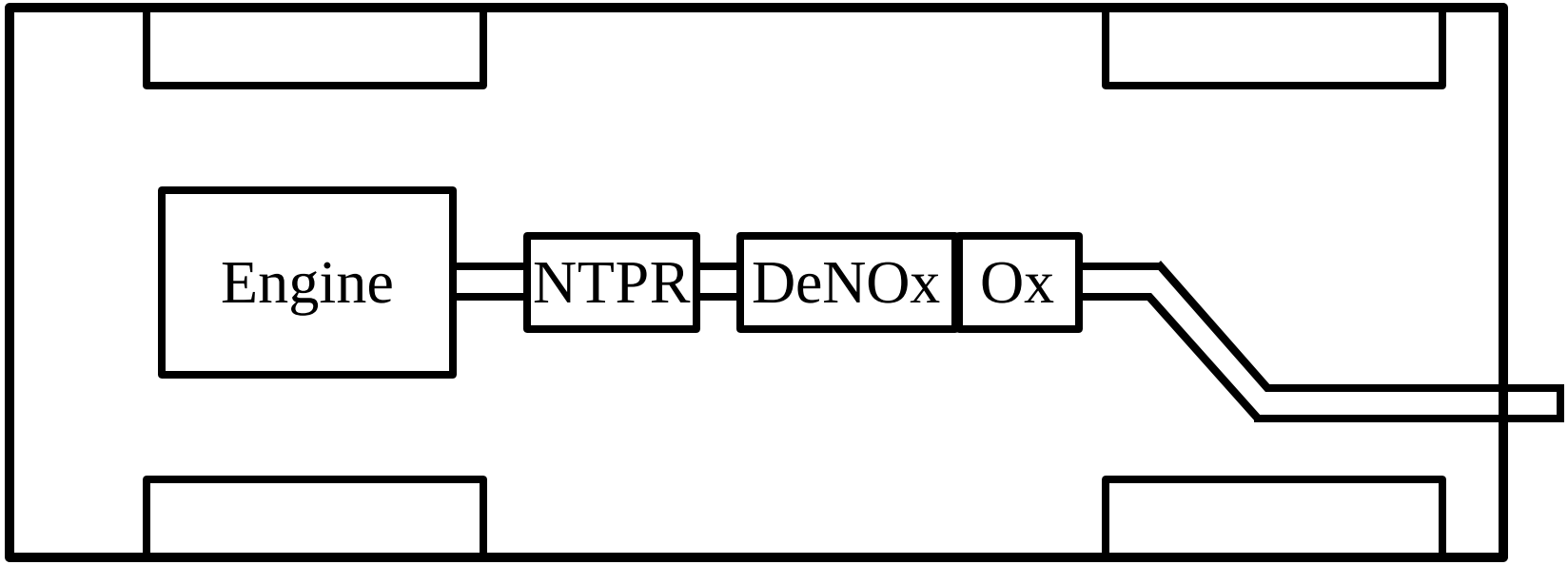
Non-Thermal Plasma Exhaust Aftertreatment
NTP System Diagram



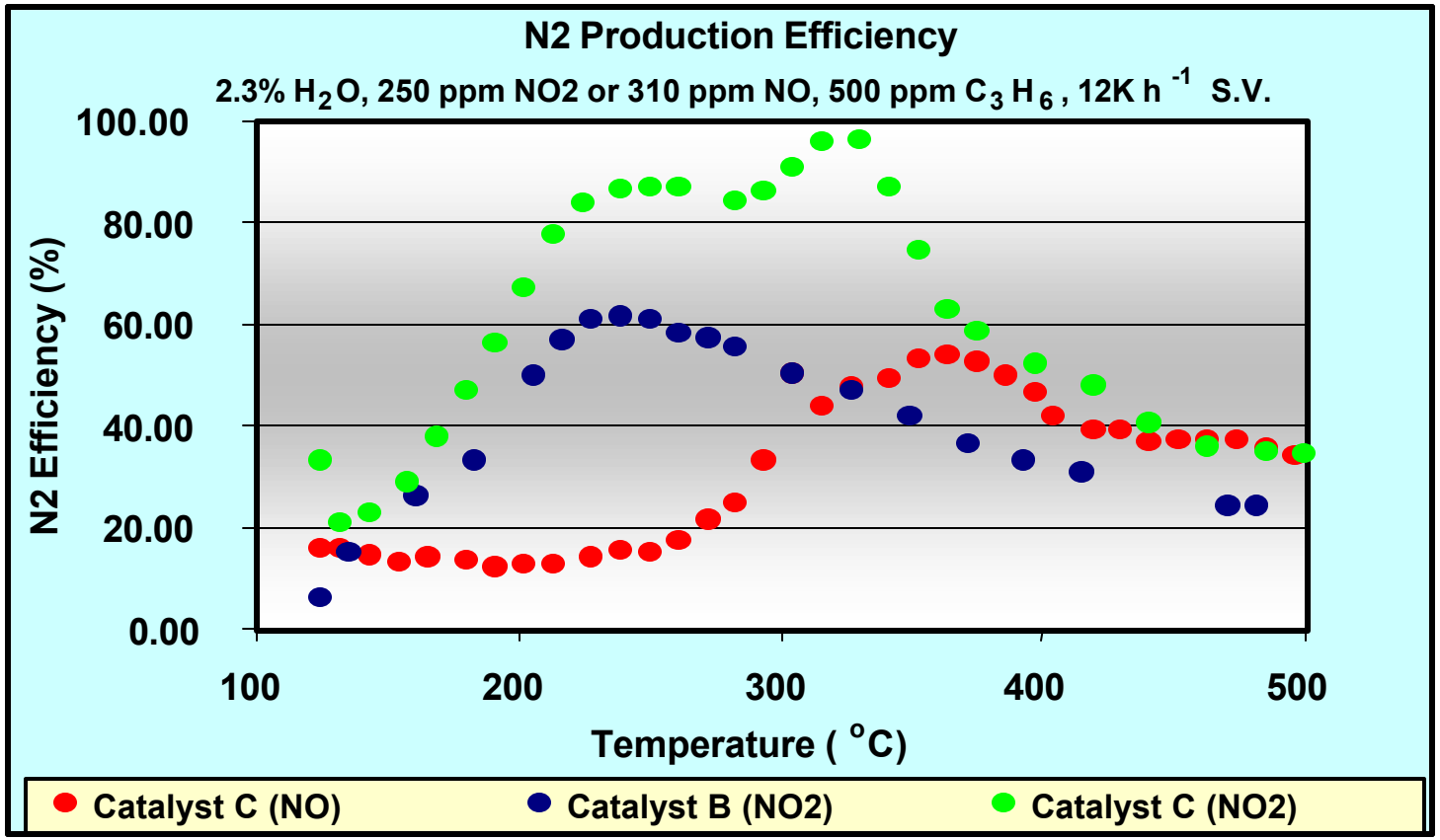
NTP Vehicle Configuration



Summary

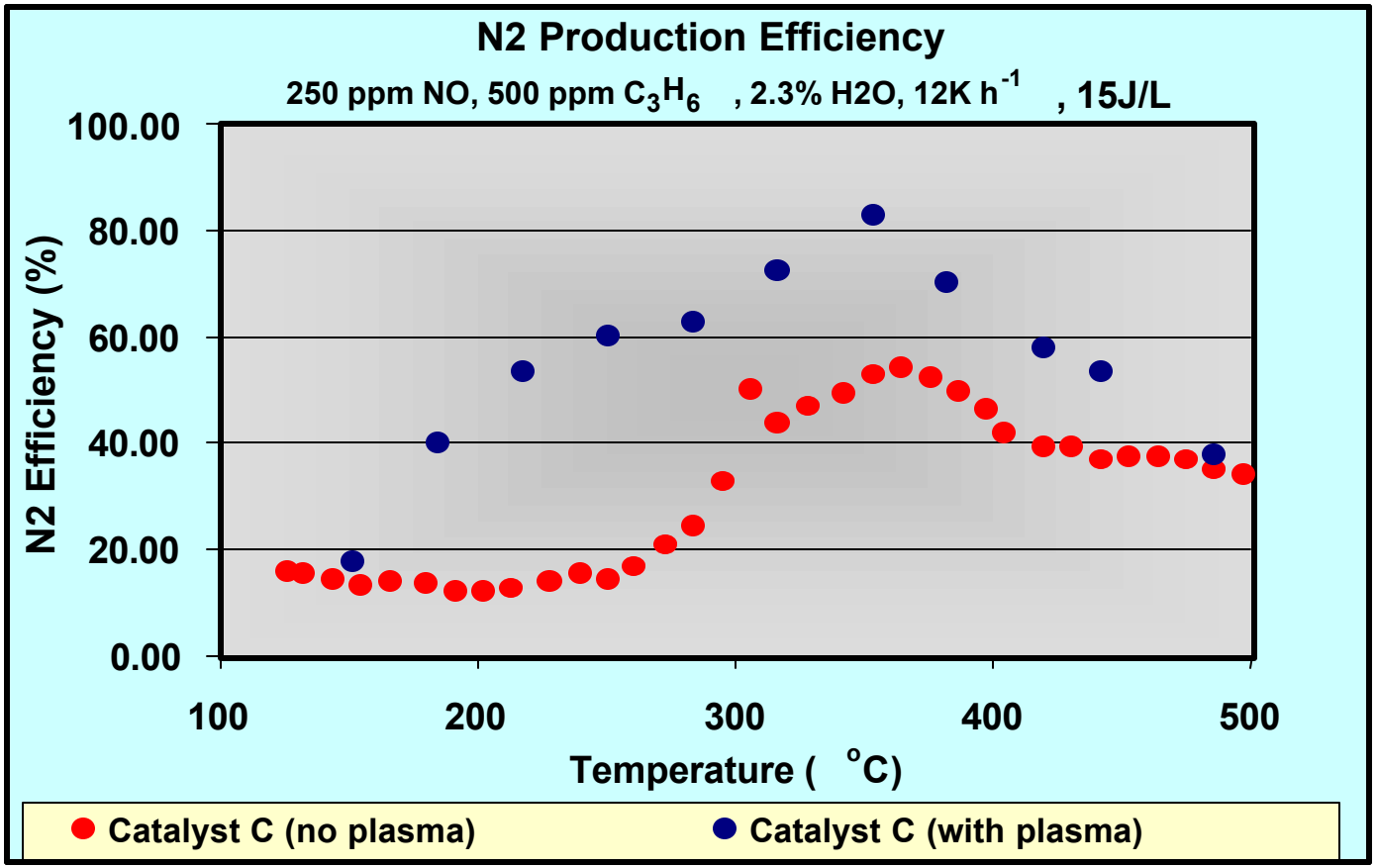
- Reactor exhibits good NO->NO_2 conversion at steady state operating points
- Modest power levels are seen at low speed/load steady state operating points
- Transient control of power and inadequate hydrocarbons dramatically reduces NO->NO_2 conversion during MVEG
- Catalyst performance at high speed/load steady state operating points appears diminished by lack of hydrocarbons
- Low system efficiency seen on this preliminary MVEG Test, with higher NOx efficiency on ECE than on EUDC
- Better transient control of power and hydrocarbons should realize great rewards for system efficiency

N_2 Production Efficiency Comparison



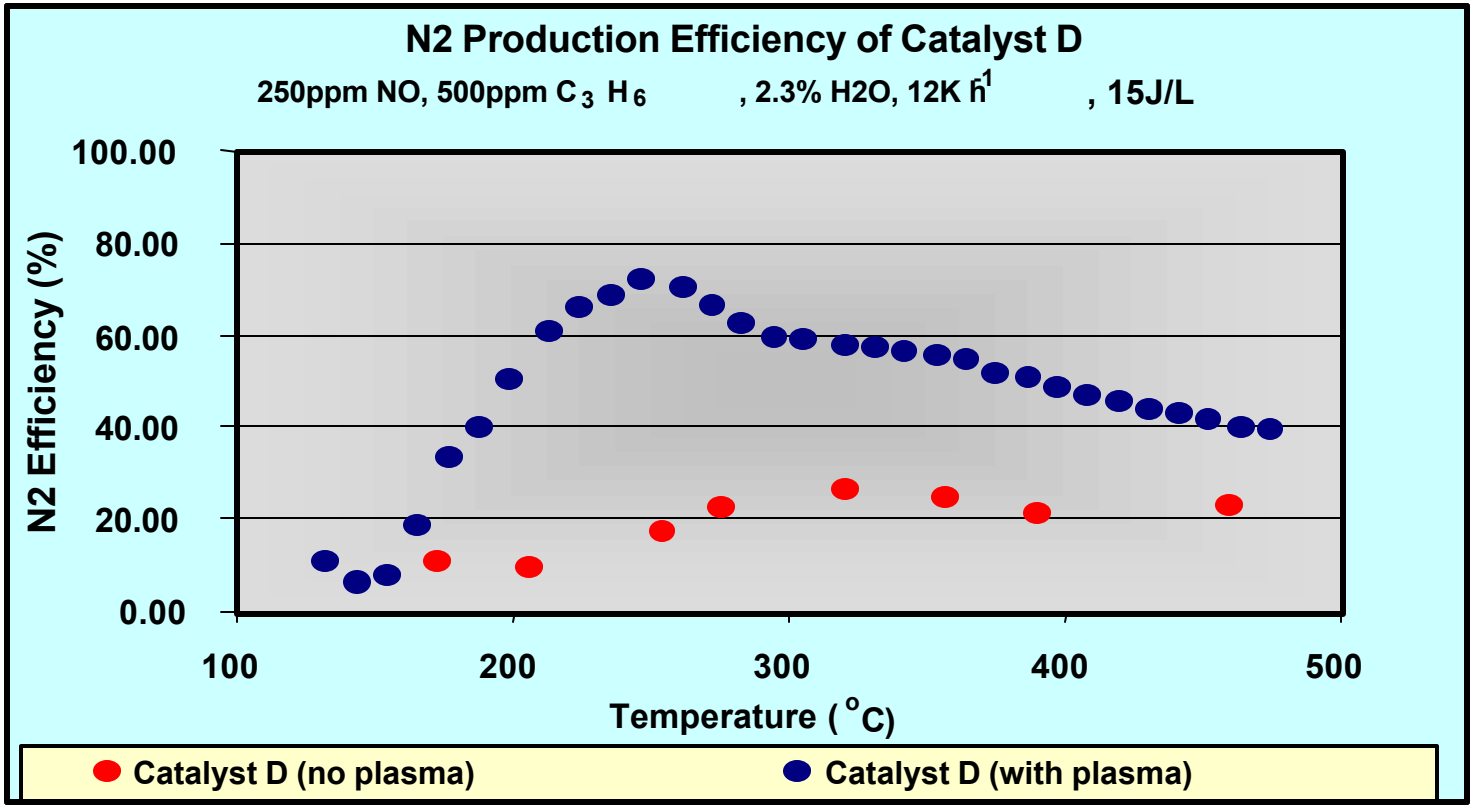
- In testing with a slow temperature ramp and NO_2, Catalyst C is clearly superior to Catalyst B.
- Catalyst C appears to promote the NO to N_2 reaction above 300°C

Effect of Plasma on Catalyst C Activity



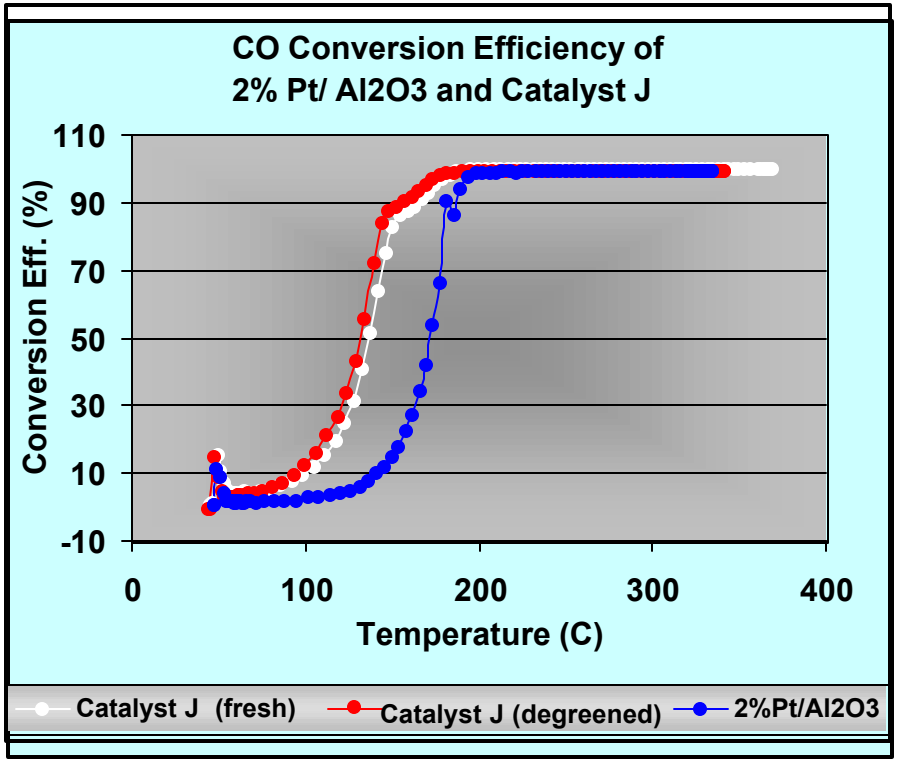
- Plasma causes large increase in catalyst activity at both low and high temperatures.

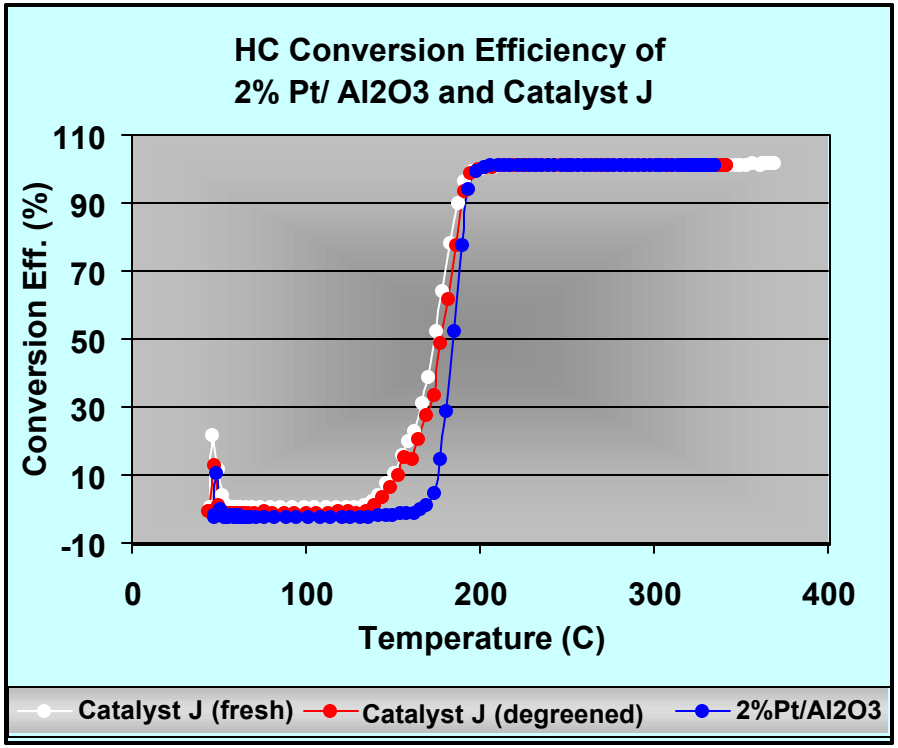
Catalyst D N_2 Efficiency Comparison



- Catalyst D is improved by plasma treatment of the gas much more than is Catalyst C.

New Catalyst for CO and HC Oxidation

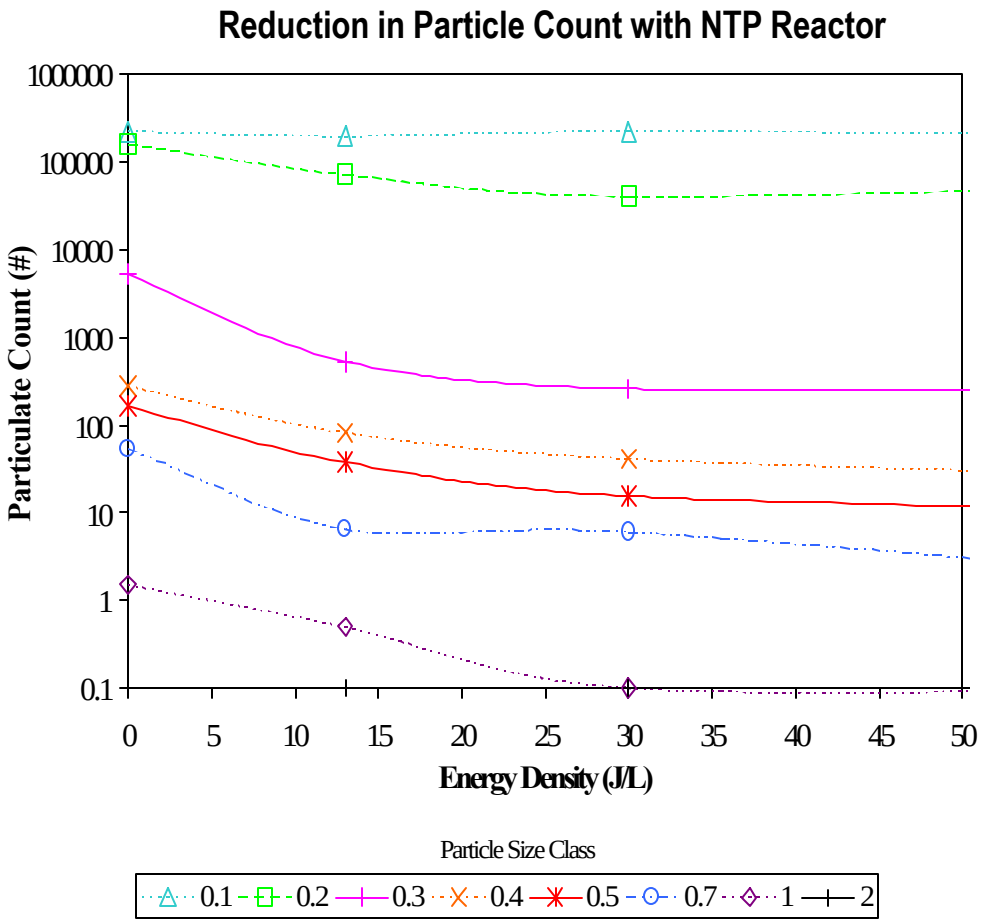




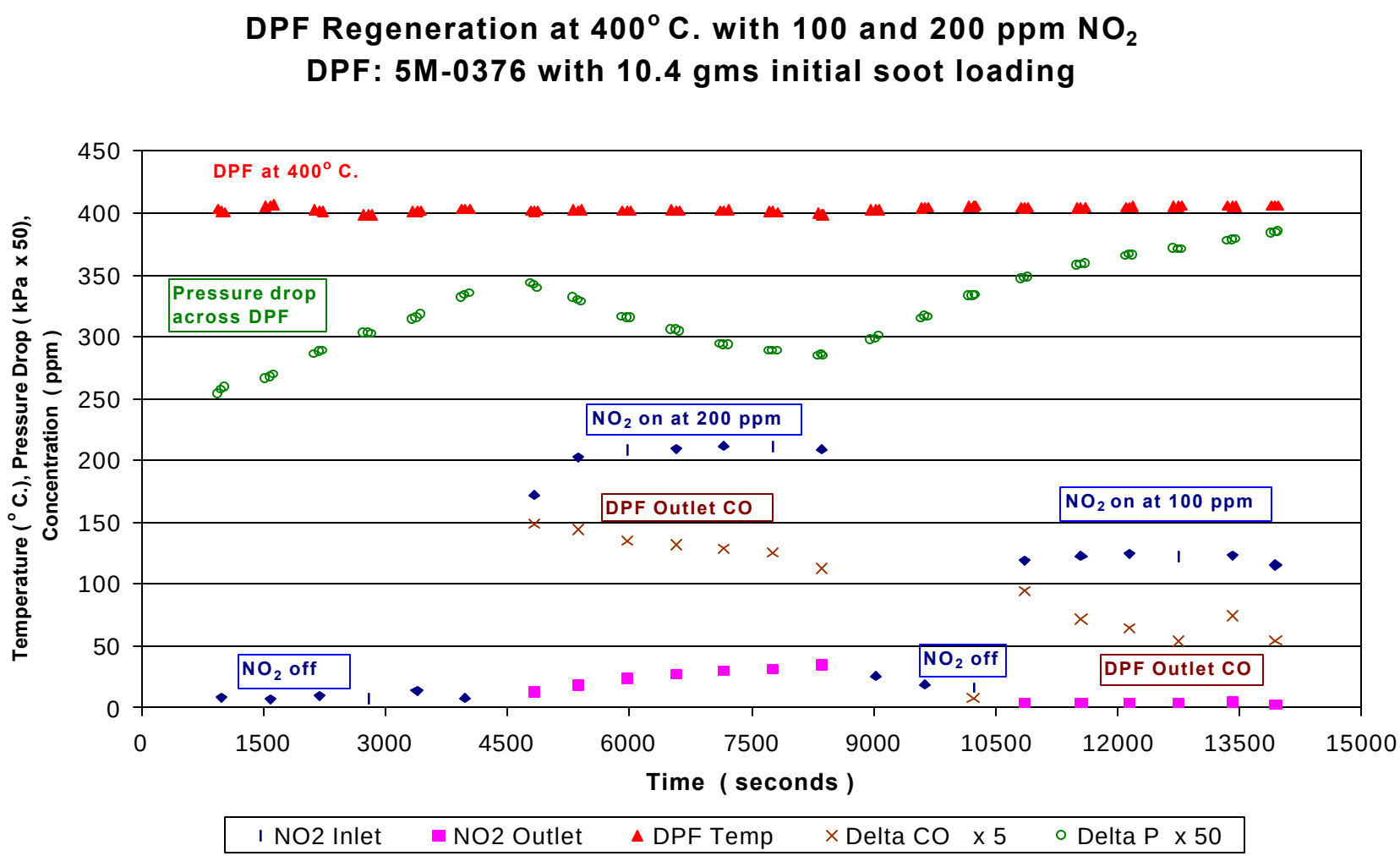
- CO oxidation has light-off near 130°C, while HC lightoff is closer to 180°C in SGB testing.

Direct Reduction of Particulate Matter

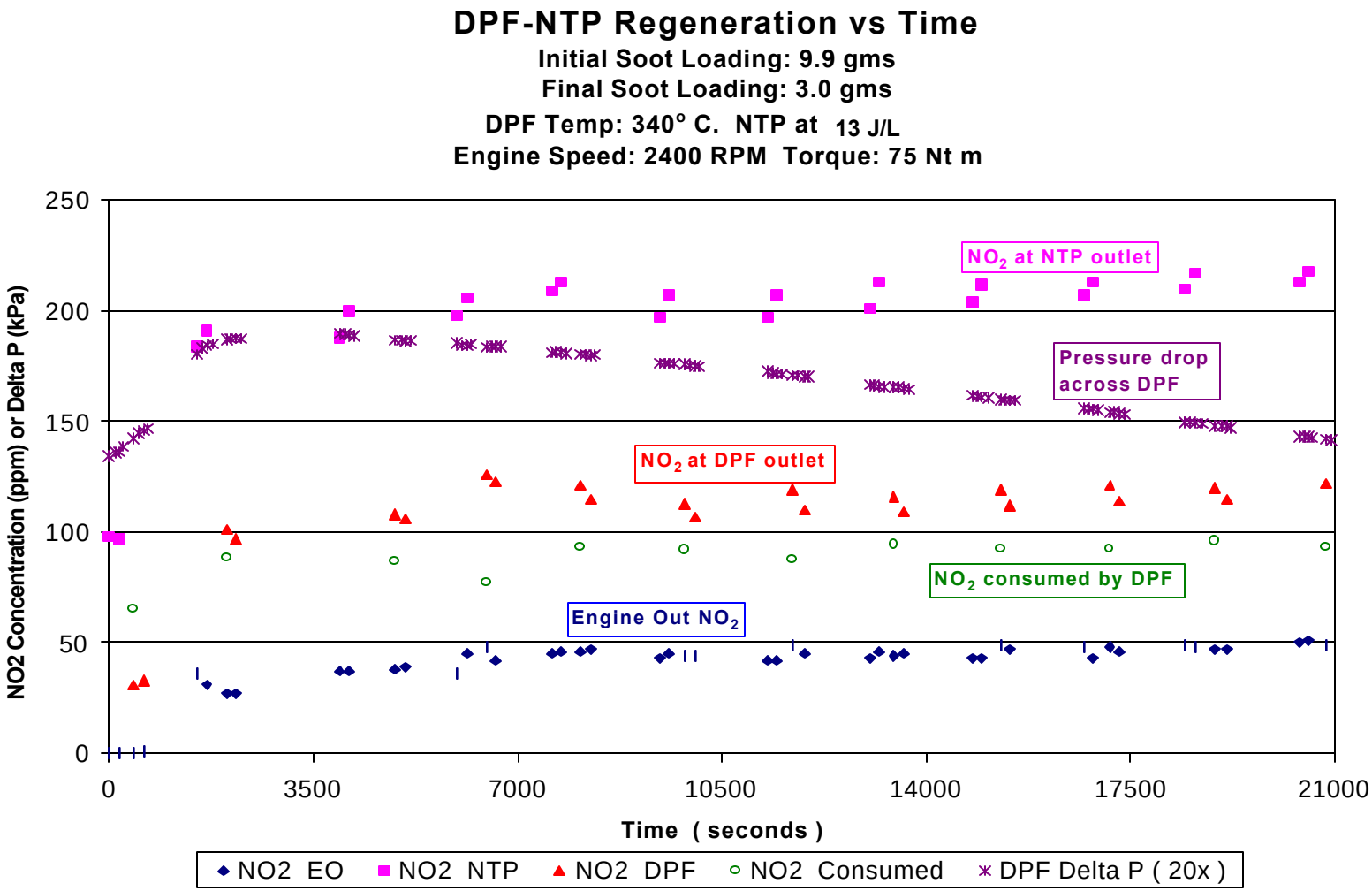
- Direct oxidation of particulate matter with NTP reactor
- Significant reduction in the number of relatively large particles
- Reduced impact on smaller particles (< 0.2 µm)
- Increase in CO_2 concentration associated with the reduction of PM
- 32% reduction in total particle count
- Mass accumulation on filter (plasma off vs plasma on) accounts for approximately 30% reduction in mass



DPF Regeneration by NO_2 (Injected)



DPF Regeneration by NO_2 (NTP Assist)



Future Work

- Improve transient and high load/RPM calibration
- Continue catalyst formulation development
- Complete plasma-assisted DPF regeneration investigation
- Optimize total system for higher overall activities
- Upscale system for heavy-duty applications