Dow Automotive

Advanced Ceramic Filter For Diesel Emission Control

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Dow Automotive
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Outline of Presentation

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- Emission regulations
- DPF development perspective
- ACM material properties
- ACM DPF performance
- Catalyzed ACM DPF
- Summary

Emission Regulations
(Light Duty)

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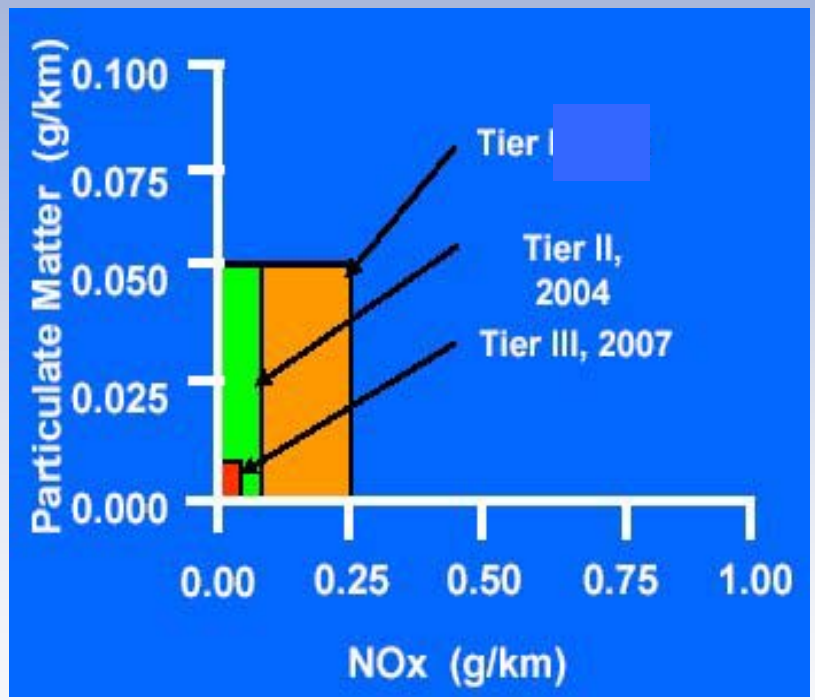
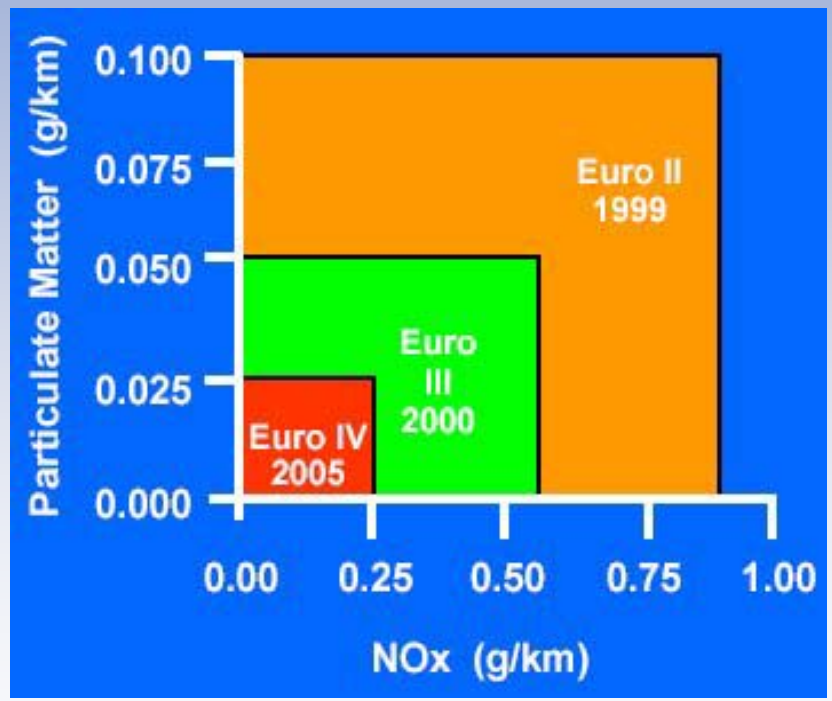
NA



EU



Emission Regulations (Heavy Duty)

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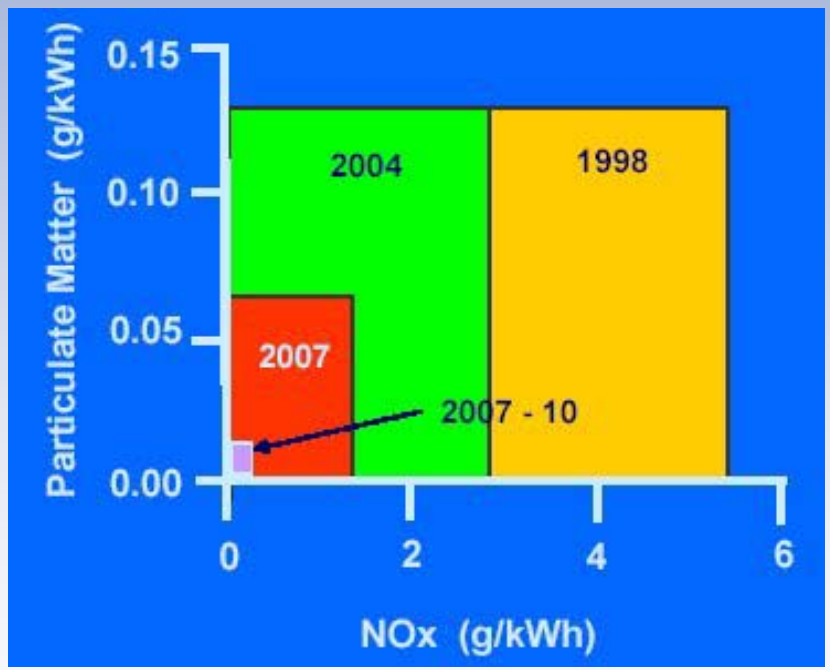
NA



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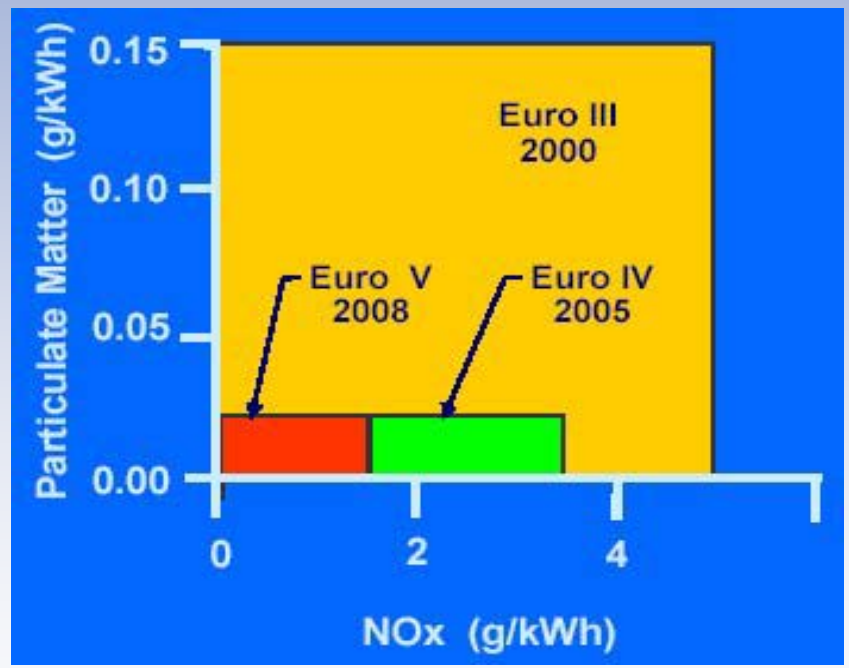

Current ACM DPF

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5.66” diameter circular DPF

5’’×6.5” oval DPF

ACM DPF Development Perspective

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- Regulation
  - High filtration efficiency
- Performance
  - Low back pressure
  - Faster regeneration
  - Durable for thermal stress / shock
  - Minimum maintenance
  - No effect on engine operation
- Cost effective

Physical Properties of ACM

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ACM - honeycomb wall porosity:	60± 2 %
Honeycomb cell density:	200 cpsi
Honeycomb wall thickness:	~ 14 mil
Substrate density	0.5 kg/L
Melting temperature:	> 1600 deg C
Elastic Modulus of wall material (25°C):	~ 20 Gpa
Poisson's ratio of wall material (25°C):	0.18 – 0.22
MOR of wall material (25°C, av max bending strength):	30 MPa
Thermal conductivity (1000°C)	1.1 W/m-K

Coefficient of Thermal Expansion:

Temperature (°C)	C.T.E. (10^{-6} / °C)
200	3.95
600	4.95
1000	5.50
1200	5.70

ACM Structure Overview

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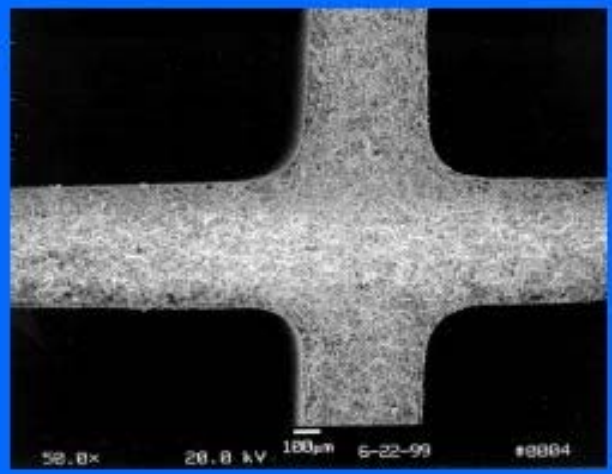
Cordierite and Silicon carbide

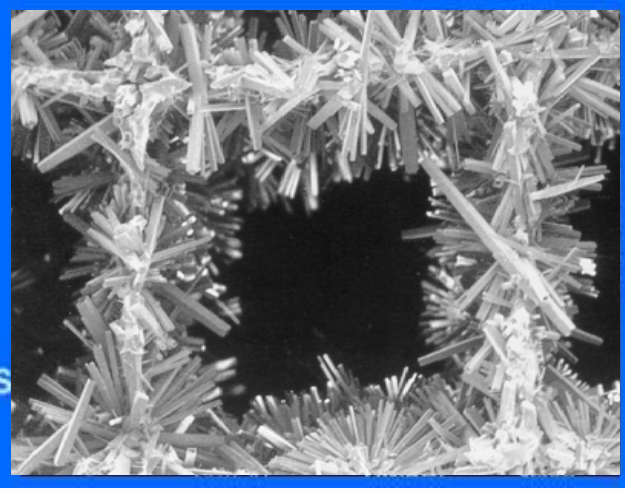
- ~ 45% porosity
- "pile-of-stones" microstructure



Washington Monument
Height: 555 ft., Weight: 90,000 tons

Advanced Ceramic

- ~60% porosity
- "pile-of-sticks" microstructure
- interlocked felt of single crystal needles



Eiffel Tower
Height:: 984 ft., Weight: 7,000 tons

ACM DPF Chemical Resistance

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Treated with 9% H2SO4 at T=80C for 6 Hours

Treated with 14% HNO3 at T=80C for 6 Hours

Un - treated Sample

ACM DPF Filtration Efficiency

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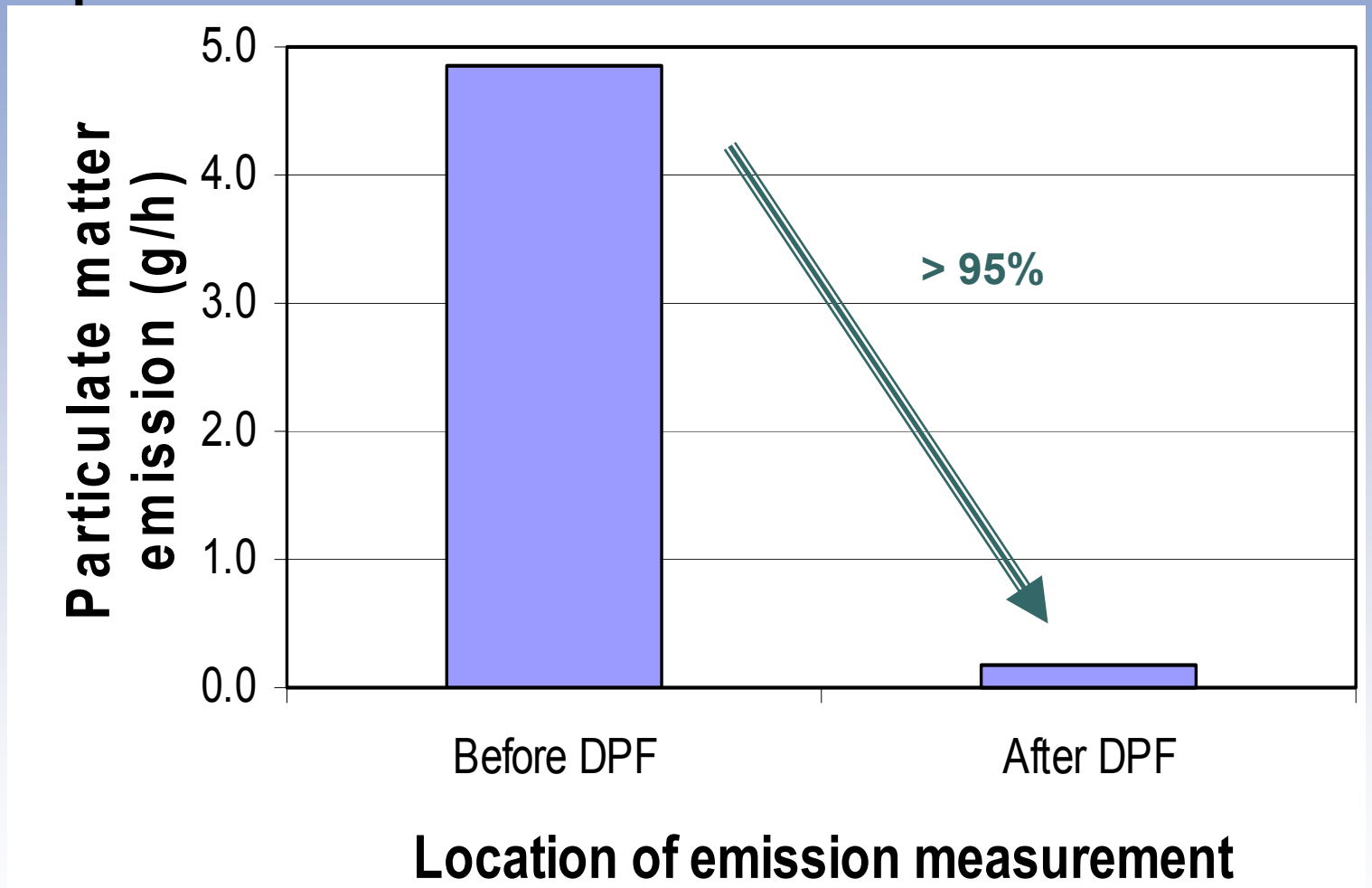

DPF Pressure Drop Comparison

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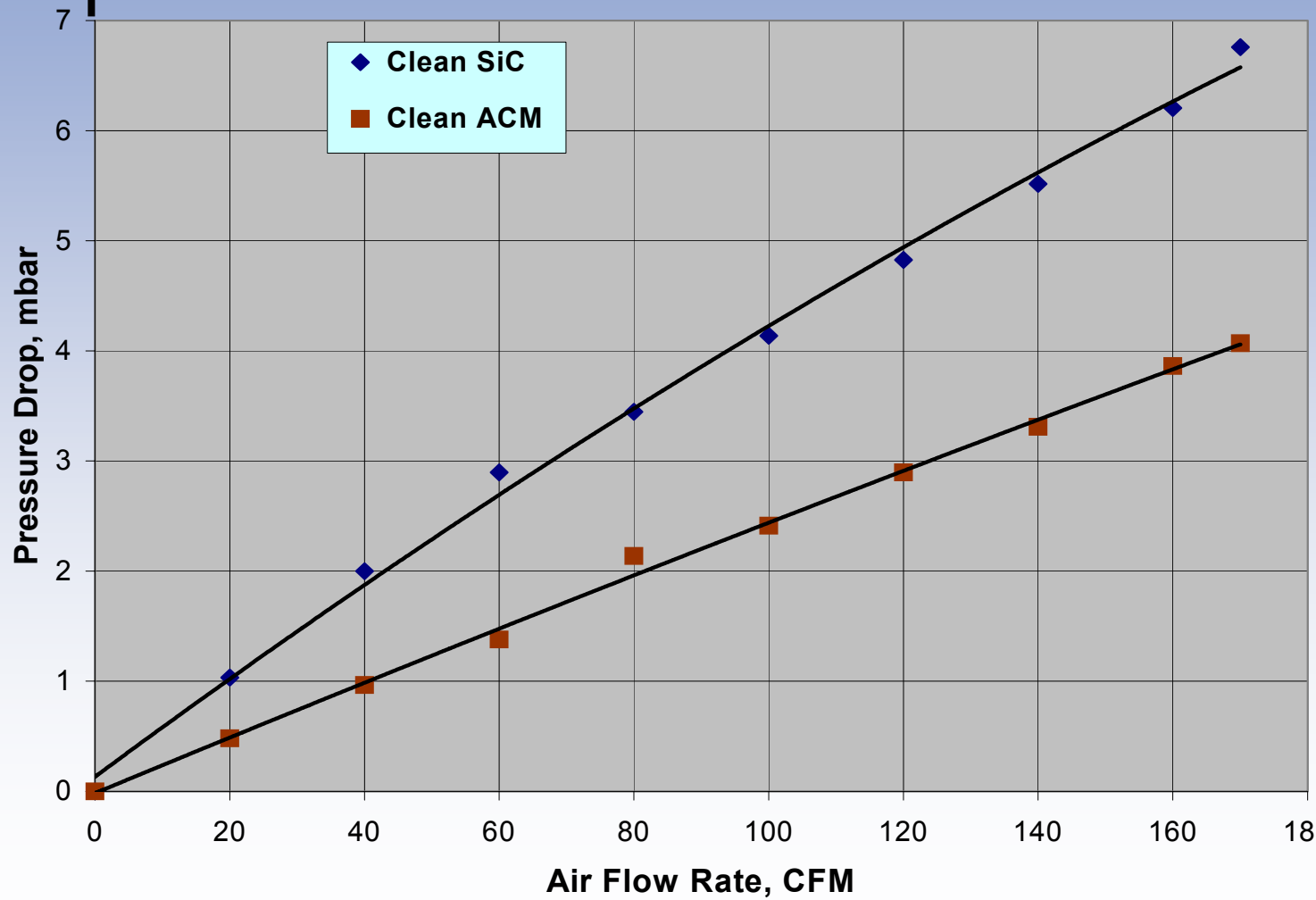
Before soot loading



DPF Pressure Drop Comparison

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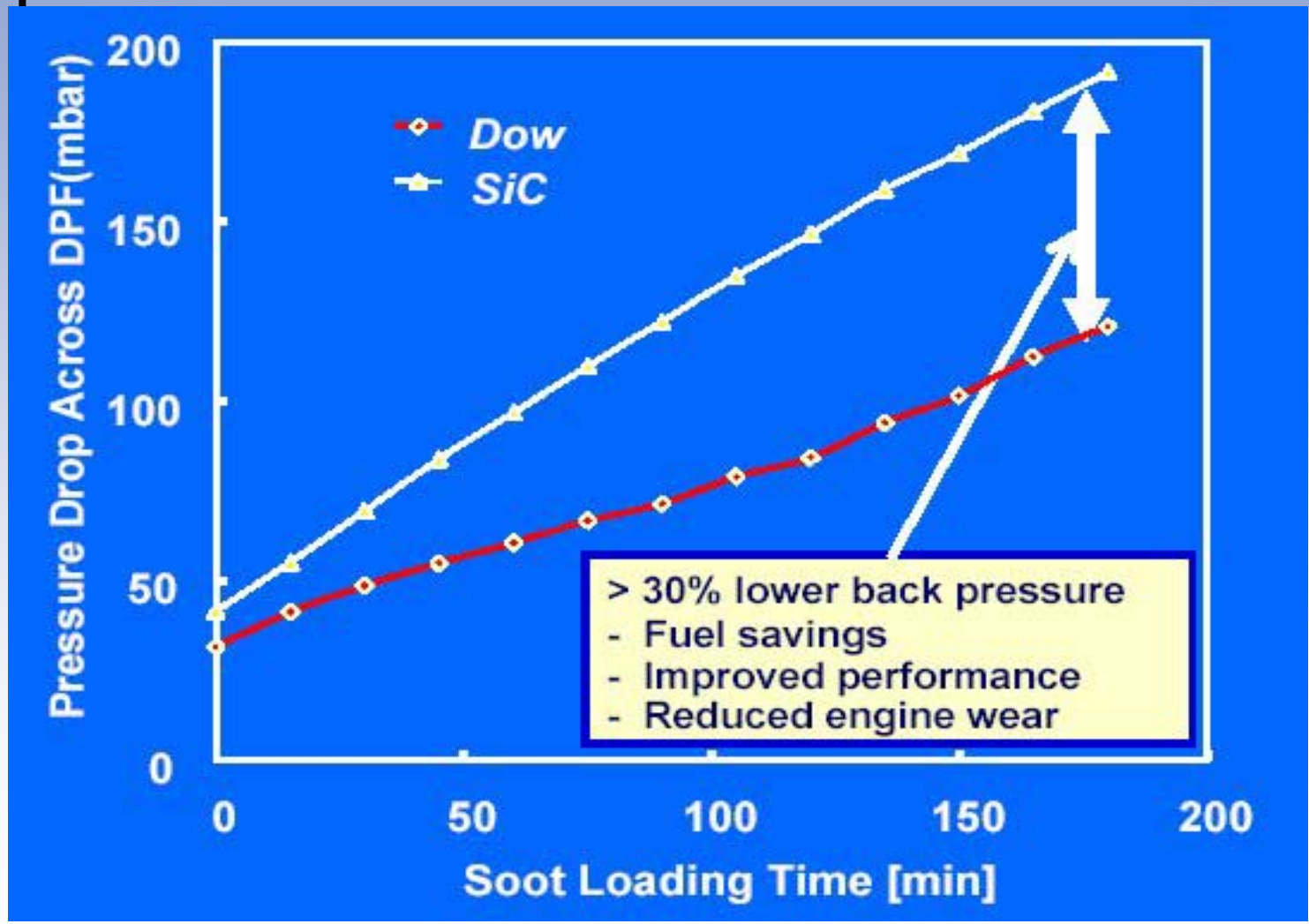
Soot loading to 8g/l



DPF Regeneration on Engine

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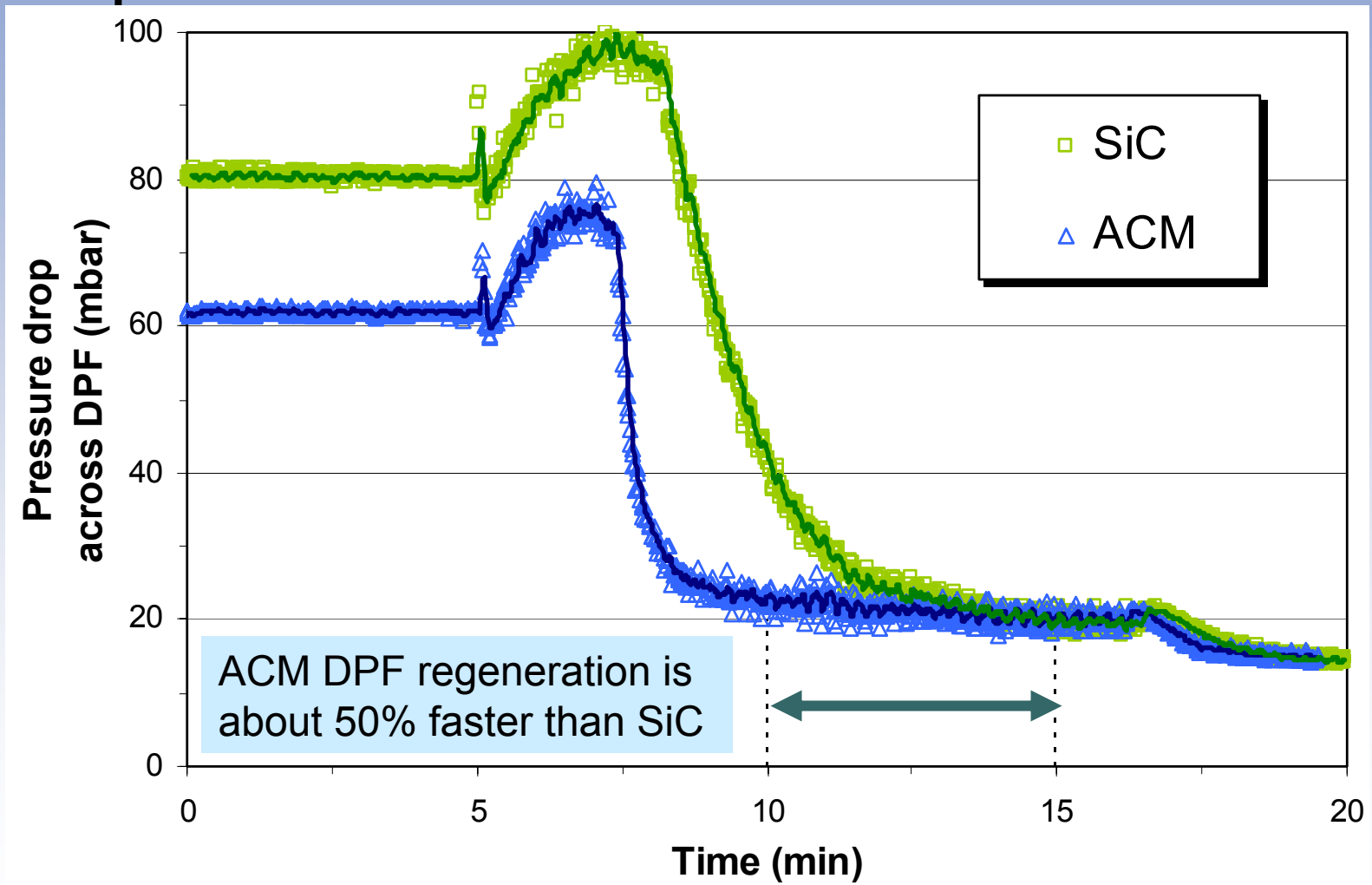
8 g/l soot on DPF



DPF T Profiles with Uncontrolled Regeneration

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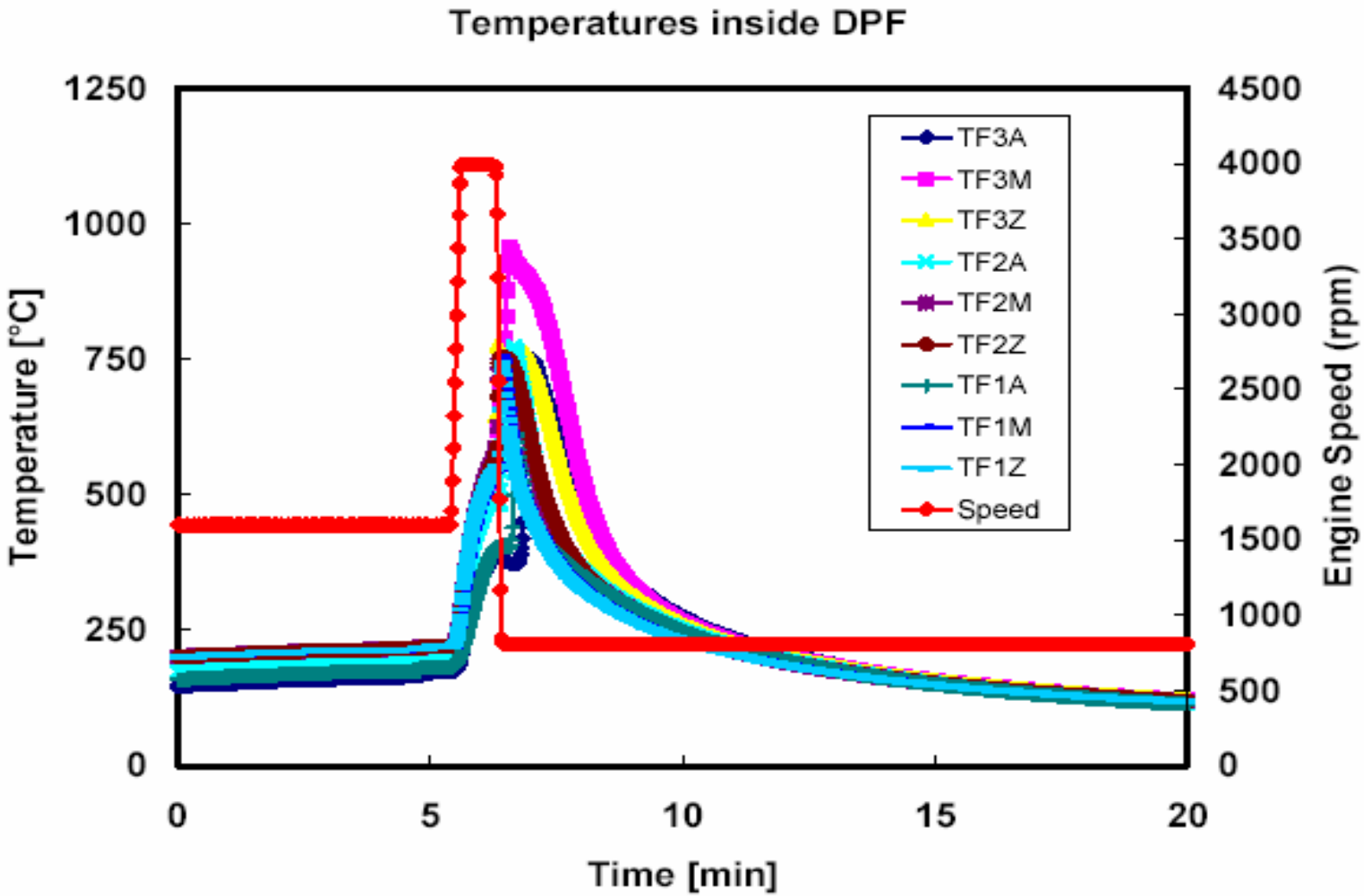

Catalyzed ACM DPF & Pressure Drop

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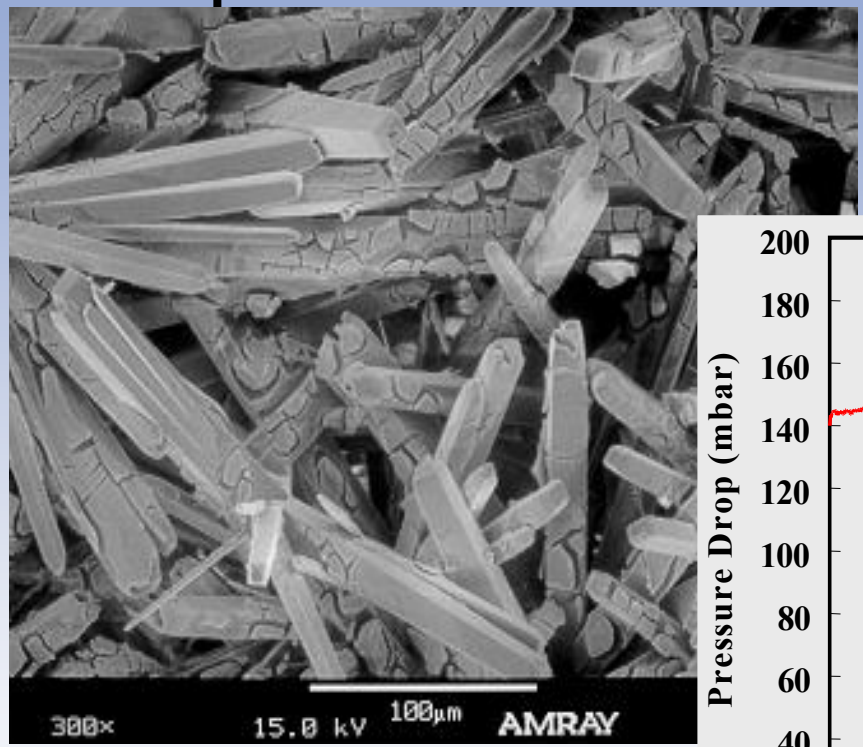
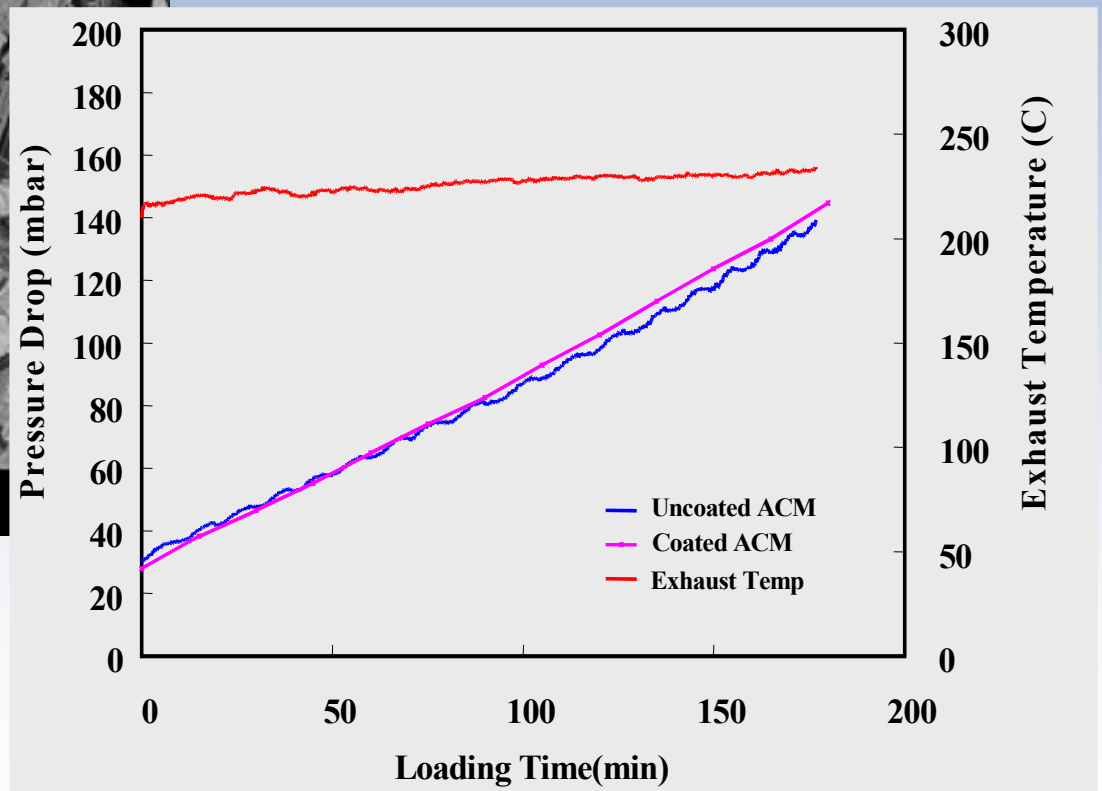


Catalyst coated ACM DPF



Back P during soot loading

Pressure Drop: Coated ACM vs uncoated SiC

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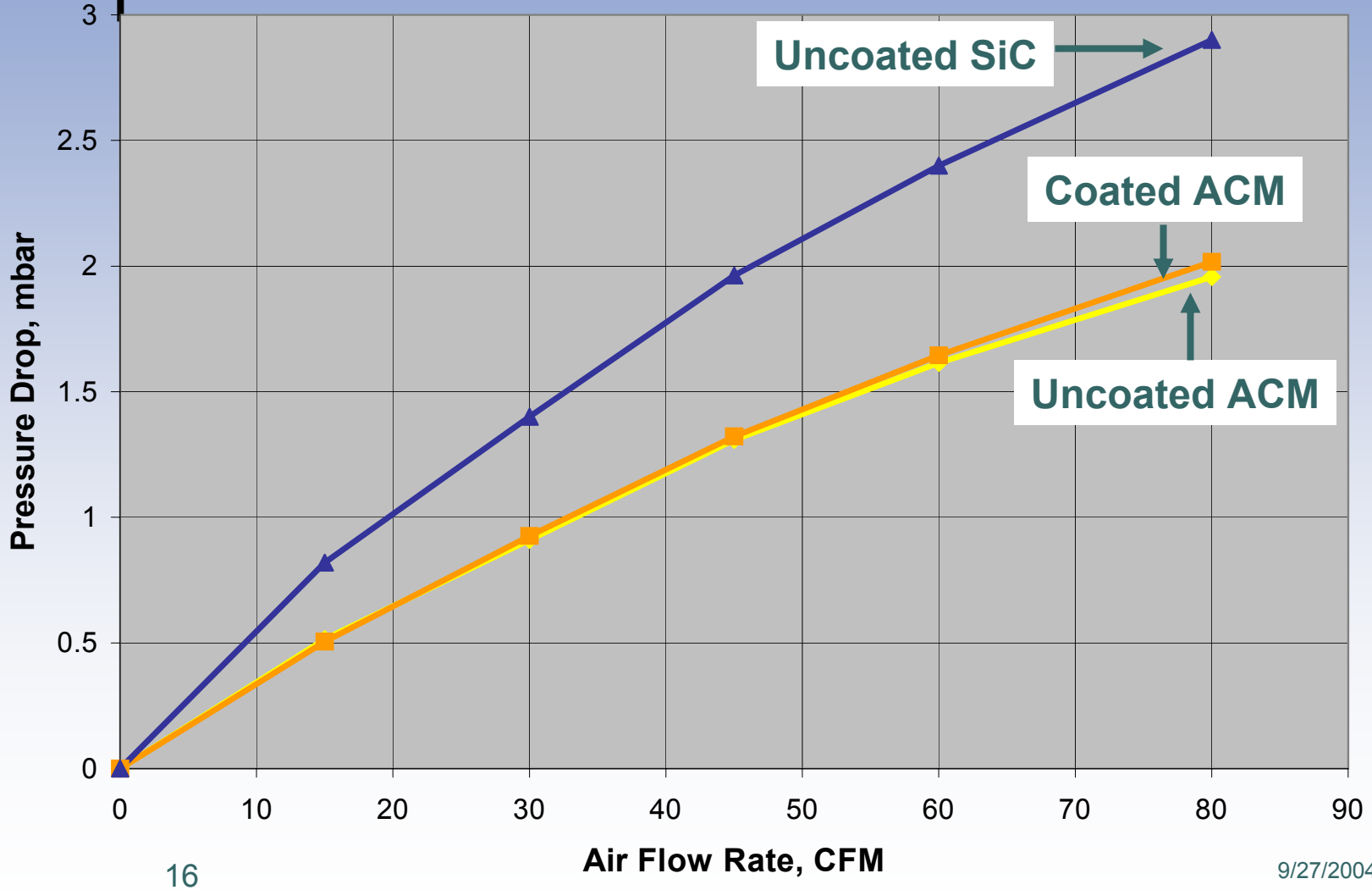

Summary

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- ACM DPF has high porosity
- ACM DPF has superior chemical resistance
- Engine tests have demonstrated that:
  - Filtration efficiency > 95%
  - 30~50% lower back pressure than SiC
  - Faster regeneration compared to SiC
- ACM DPF also has great potential for DOC and NOx catalyst applications