

Estimating PM and PN emissions with the SRM Engine Suite coupled to a 1D engine cycle model



SRM Engine Suite integrated with a commercial 1D engine cycle simulator to model engine-out and tailpipe emissions

THE CHALLENGE

Accounting for the effects of different compositions at engine-out on tailpipe emissions in internal combustion engines.

THE SOLUTION

Applying the physico-chemical SRM Engine Suite software coupled with a 1D engine cycle simulator containing aftertreatment to model the fuel oxidation, combustion, engine-out and tailpipe emissions.

THE RESULTS

- Detailed engine-out and tailpipe emissions as a function of **fuel**, **combustion mode**, and different **exhaust after-treatment (EAT) configuration**
- **PM** and **PN** emissions at engine-out and tailpipe
- Capability to model conventional and alternative fuels via chemical kinetic schemes for fuel oxidation and emissions pathways

OVERVIEW

The probability density function (PDF)-based Stochastic Reactor Model (SRM) Engine Suite was applied as a co-simulator within a 1D engine cycle model to simulate the entire chain, i.e. from a fuel model (in this case a Diesel fuel), through to engine-out and tailpipe emissions in a compression ignition direct injection (CID) engine.

RESULTS

The model used to obtain the results listed below is outlined in Figure 1.

Property	Value
ENGINE OUT	
Soot flowrate [mg/h]	3.60E+03
PM [mg kW/h]	48.0
PN [mg kW/h]	1.32E+14
DPF	
Soot retained [mg/h]	1.21E+03
TAILPIPE	
Soot flowrate [mg/h]	2.39E+03
PM [mg kW/h]	31.9
PN [mg kW/h]	8.81E+13

User Story

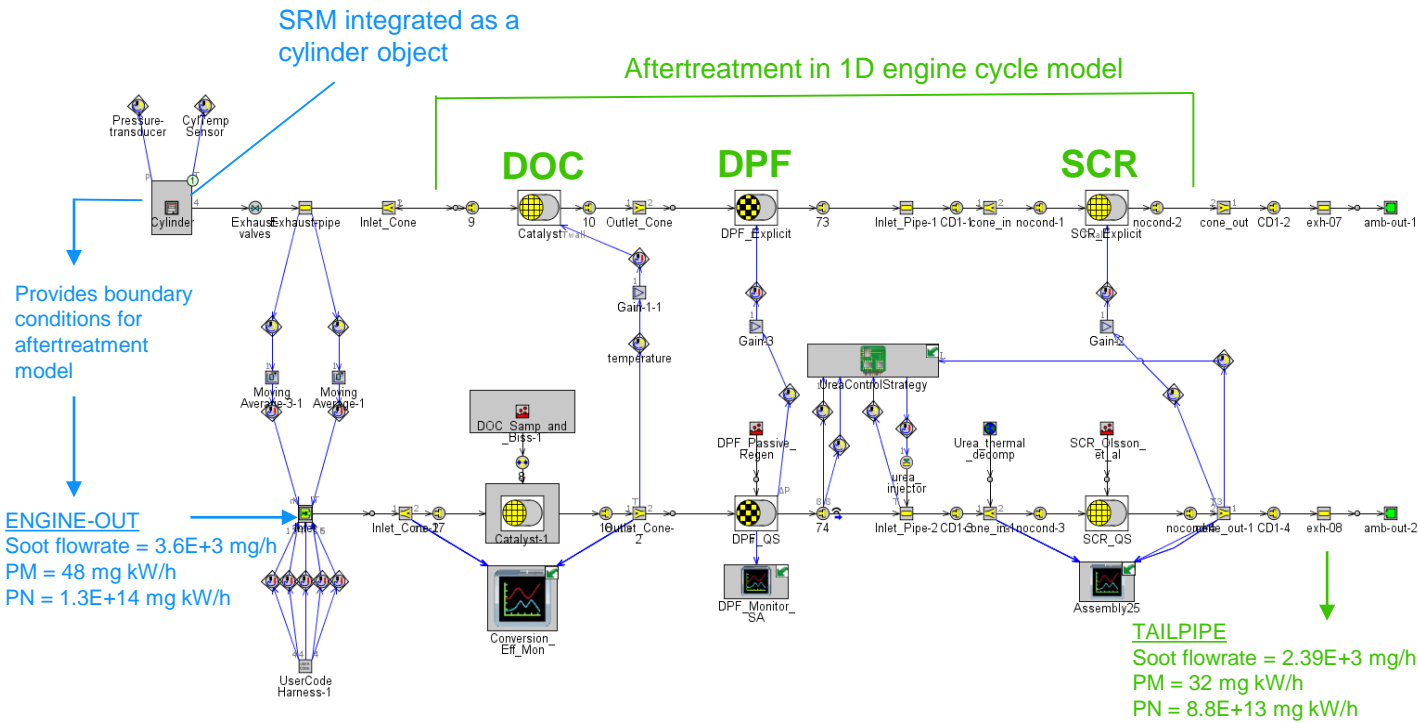


Figure 1: SRM Engine Suite coupled with the 1D engine cycle model with aftertreatment. DOC – diesel oxidation catalyst, DPF – diesel particulate filter, SCR – selective catalytic reduction.

APPLICATION AREAS

- IC engines
- Engine-out emissions
- Tailpipe emissions

PRODUCTS USED

- SRM Engine Suite
- Chemical model for Diesel oxidation, soot and NO_x
- 1D engine cycle simulator

Soot retained at DPF

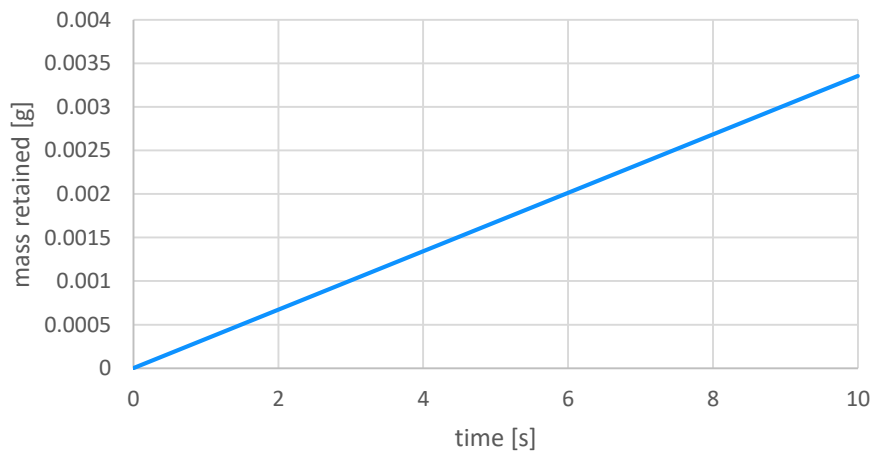


Figure 2: Soot mass retained at the DPF plotted with time.