

Aging of Catalysts and Filters

ESWA offers catalyst aging services of full-size catalyst substrates and DPFs (SCR, DOC or DPF) of up to 13 inches (280 mm) in diameter and 20 inches (508 mm) in length. Services include:

- Hydrothermal aging in a temperature-controlled chamber
- Accelerated aging on an engine
- Evaluation of catalyst performance in a CFR 1065-compliant engine test cell

ESWA staff has carried out a variety of aging projects for certification, end of life performance, or as input to degradation models. We are ready to use our experience with catalyst aging to develop programs that meet your needs.

In addition, ESWA offers aftertreatment fabrication services for aging or performance testing. These include:

- Remove catalyst substrates from their housing, perform hydrothermal aging, and then re-can the aged components for follow-up emissions testing
- Build modular aftertreatment systems to hold test substrates which allow quick switching of substrates

Hydrothermal Aging

ESWA's hydrothermal aging laboratory has two temperature-controlled chambers that can accommodate full-size substrates, either canned or un-canned. The chambers, shown in the schematic in Figure 1 can be heated to temperatures of up to 1200 °C and allow for precise temperature control and repeatability. Air and water flows are controllable at a wide variety of flow rates. Temperature, air flow, and water injection data at customer specified locations are acquired continuously.

Figure 2 shows an example aging run of an 11-inch diameter ceramic substrate during a 20-hour ramped aging cycle with air and water injection. During steady state periods, all temperatures were within 4 °C of the target temperature.

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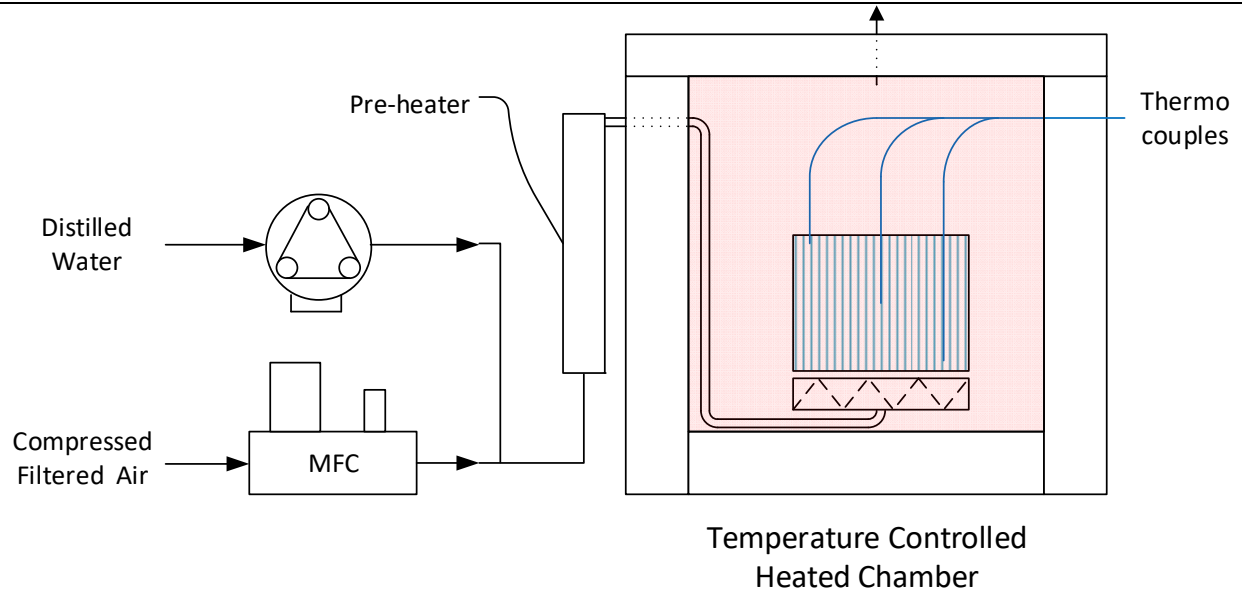


Figure 1: Schematic of the ESWA hydrothermal aging apparatus

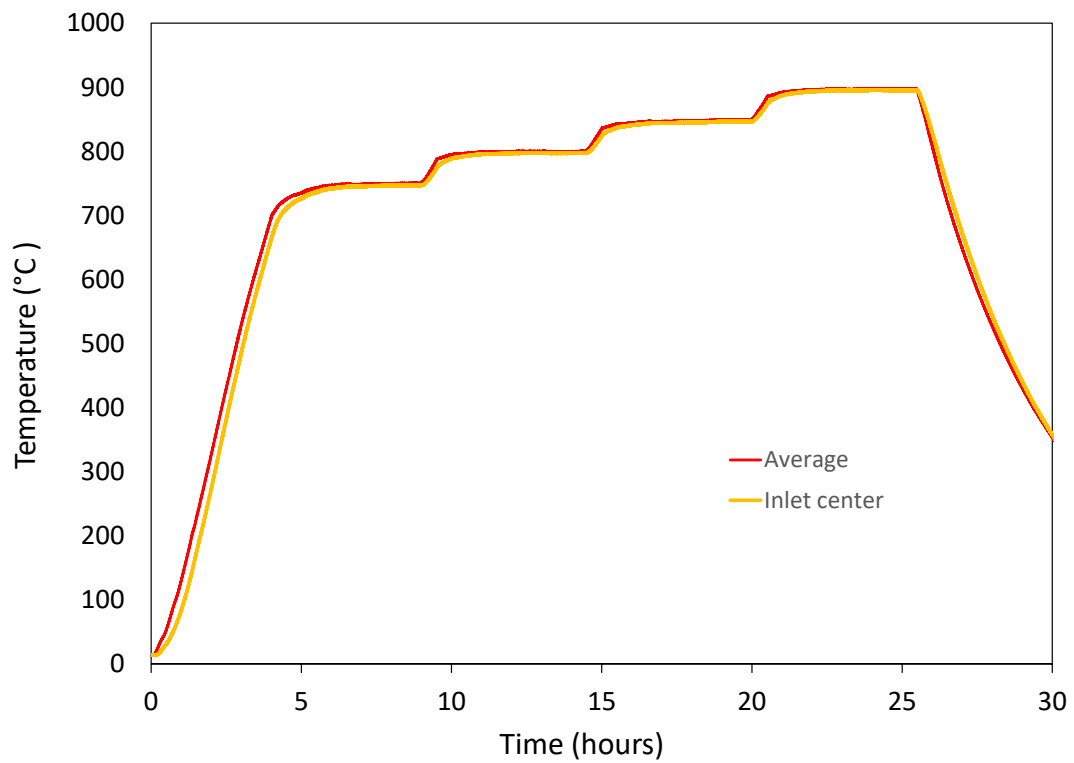


Figure 2: Temperature traces for a catalytic substrate during a 20-hour ramped aging cycle with air and water injection.

Accelerated On-Engine Aging

ESWA’s accelerated aging program uses a diesel engine on a steady-state dynamometer. Full-size catalysts or DPFs are installed downstream of a DOC in the exhaust system of the engine, and supplemental diesel fuel is injected to create post-DOC temperatures as high as 750 °C for extended periods of time. An example set-up is shown in Figure 3 below.

Figure 4 shows an internal temperature trace of DPF with 12 inch diameter x 11 inch length (305 x 280 mm) during a portions of the CARB rapid accelerated aging cycle* with a 700 °C target temperature. In this example, supplemental fuel injection started at 37 minutes (with an engine exhaust temperature of approximately 500 °C).

Accelerated aging protocols such as the CARB Aftermarket Procedure† can be followed, or custom cycles can be developed (within the bounds of the steady-state dynamometer’s capabilities). The impact of oil consumption can be simulated as well.

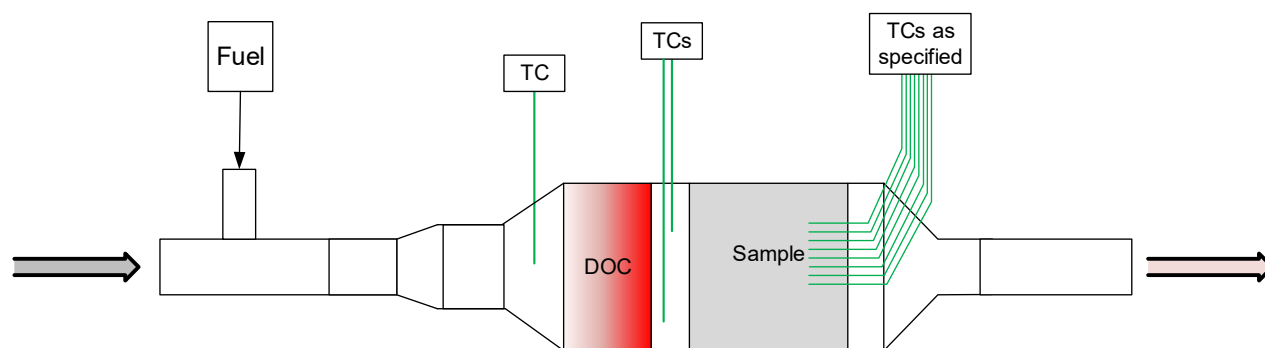


Figure 3: Schematic of the accelerated aging exhaust system.

* A complete accelerated aging cycle consists of two consecutive 2007 ramped-modal cycles followed by 40 minutes of DPF temperature of 700 °C ± 50 °C, with appropriate transitions between the phases.

† “California Evaluation Procedure For New Aftermarket Diesel Particulate Filters Intended As Modified Parts For 2007 Through 2009 Model Year On-Road Heavy-Duty Diesel Engines”, California Air Resources Board, 2017

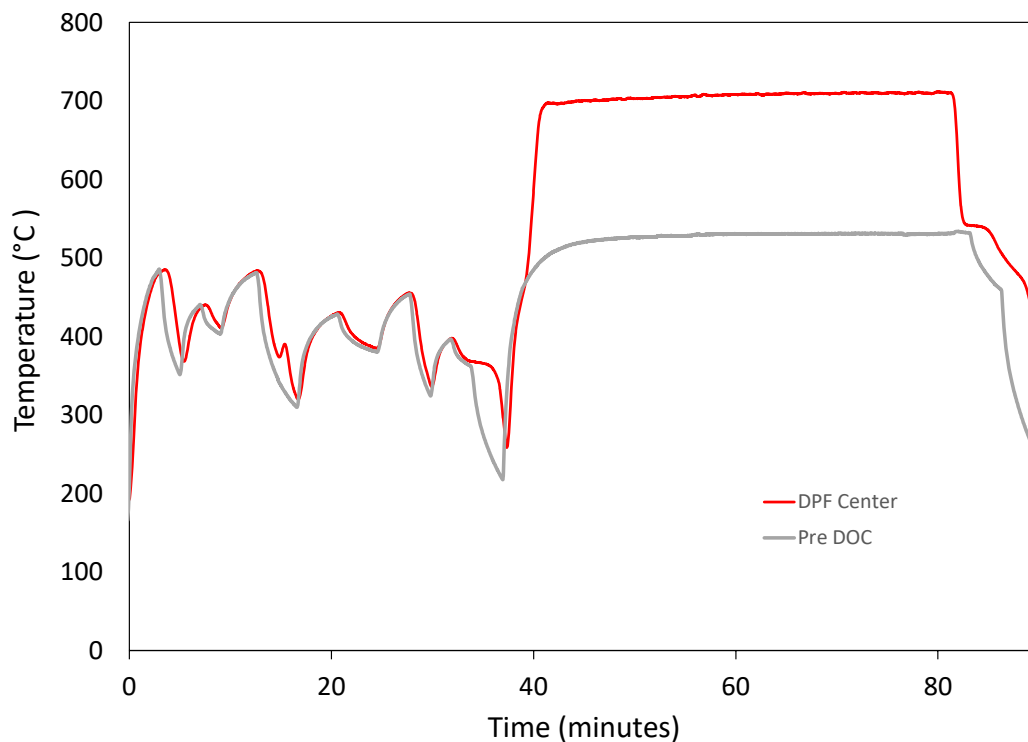


Figure 4: Internal temperature trace of DPF during a CARB rapid accelerated aging cycle of a DPF.

Emissions Testing on Engines

Emissions testing can be part of your aging program at ESWA. For example, a sequence of baseline testing, hydrothermal aging, intermediate testing, additional aging, and so forth.

ESWA's capabilities include:

- AC transient 1,000 hp and 500 hp engine dynamometers with motoring capabilities
- A heavy-duty chassis dynamometer with capacity of up to 575 hp
- Standard or custom test cycles available
- Diesel, gasoline, CNG, LNG, propane, LPG, and dual fuel capabilities

The engine dynamometers and emissions equipment are CFR 1065-compliant; the chassis dynamometer is CFR 1066 compliant.



The test cells have variety of emissions sampling equipment:

- Full flow CVS & partial flow system
- Gaseous emissions (Horiba MEXA 7200): NO_x, NO₂, NO, THC, CH₄, CO, CO₂
- NH₃ measurement using MKS FTIR
- Double dilution gravimetric PM, Horiba MDLT partial flow PM
- PM elemental and organic carbon (EC:OC) speciation
- Wet/dry chemical lab capabilities
- Other capabilities upon request: raw emissions measurement, urea storage and distribution, PM sulfate and nitrate analysis

Contact

For further information, please contact us through ESWAsales@eswgroup.com or directly by emailing Project Manager Irakli Muzashvili at lmuzashvili@eswgroup.com. We will be happy to discuss your requirements and provide budgetary quotes.