ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

Laboratory of Renewable Energy Science and Engineering

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Heat storage for enhancing the use and performance of automotive catalytic converters

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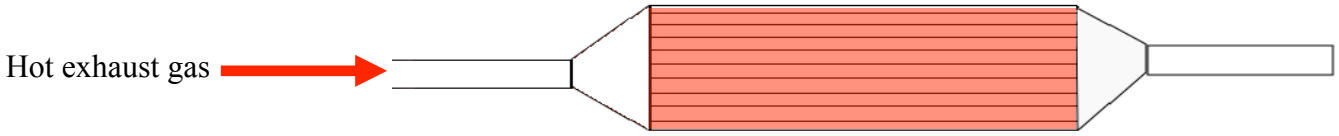
LRESE

- Project d'ingénierie simultanée

- **Heat storage for enhancing the use and performance of automotive catalytic converters**
- Project description:
  "The catalytic converter in a car must be preheated in order to minimize the emissions of the engine after a cold start. The charging and discharging behavior of a high-temperature heat storage reservoir comprising a phase-change material delivering the required heat shall be experimentally tested and optimized by a numeric heat transfer model."

Background:

- catalytic converters work only in «hot» operation



- After cold starts or longer intermediate stops several minutes until full operation of catalytic converters
- Modern engines (downsizing) with lower exhaust gas temperatures cause longer heat up phase of catalytic converter
- Recent exhaust gas regulations tighten the allowed emissions

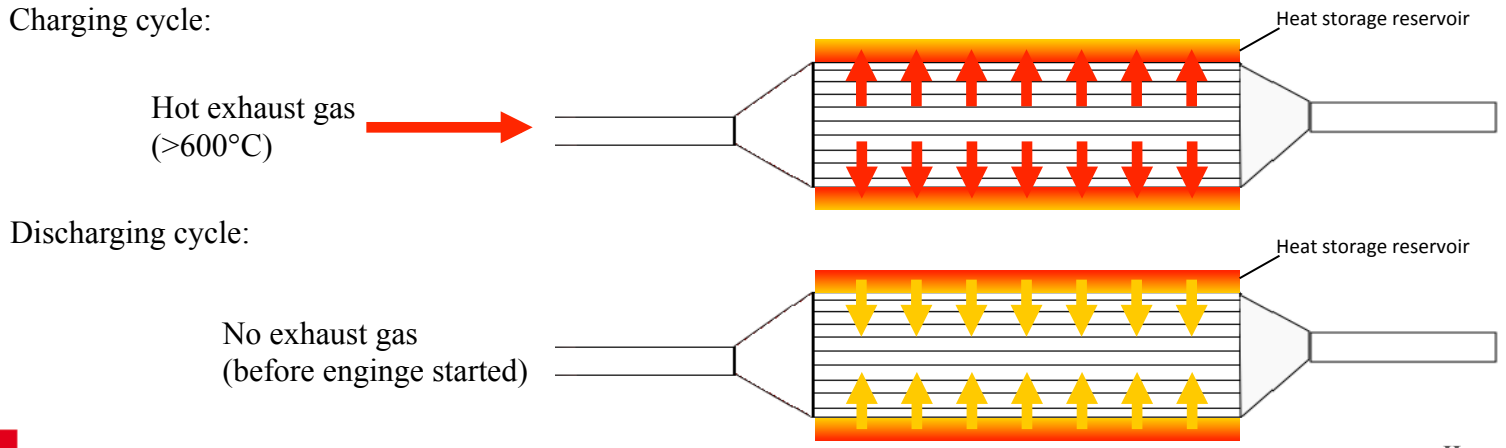
→ Methods for reduction of emissions after cold start required

Recent methods:

- Use of rich air fuel ratio in order to reduce heat up phase of catalytic converter
- Electric preheating of catalytic converter before cold start

New principle:

- Heat reservoir as heat storage
- Phase changing material (PCM) as heat storage medium
  - Example: Al-12.6%Si, 578°C
- Charging/discharging cycles



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Tasks:

- Literature review
- Experimental campaign:
  - Getting familiar with experimental setup
  - Measurement of charging/discharging behavior for various driving cycles
  - Data evaluation and post-processing
- Implementation of numeric heat transfer model:
  - Adjustments of existing basic model to current problem
  - Model validation with experimental data
  - Optimization of configuration in terms of PCM type and thickness
  - Sensitivity analysis
- Further investigation as cost analysis, comparison to alternative preheating systems, etc.
- Report + Poster + Presentation

Organization:

- Teams: 2 teams of 3 students