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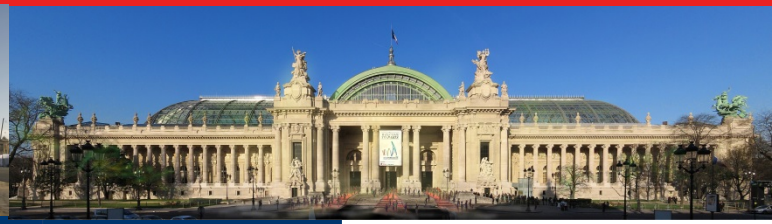

Innovative exhaust post-treatment systems for a NGV application : SCR-CH_4 – Nitrogen oxides reduction by the action of unburned methane

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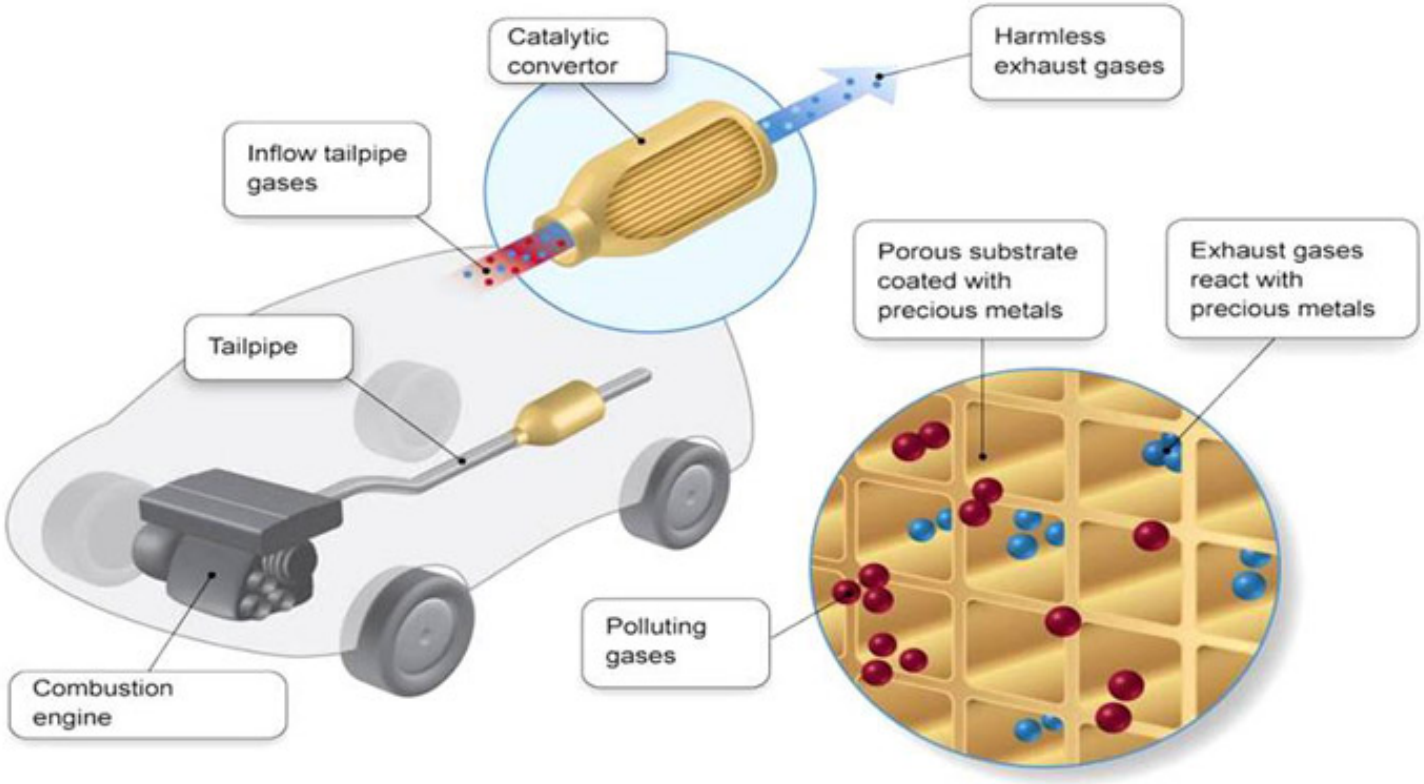
Agenda

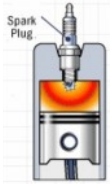
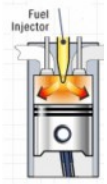
1. What is a catalytic system for control pollution
2. Current available technologies
3. The SCR-CH_4 Technology
4. Objectives of the project
5. Main results
6. Conclusions and Agknoledgments

What is a Catalytic System for pollution control?



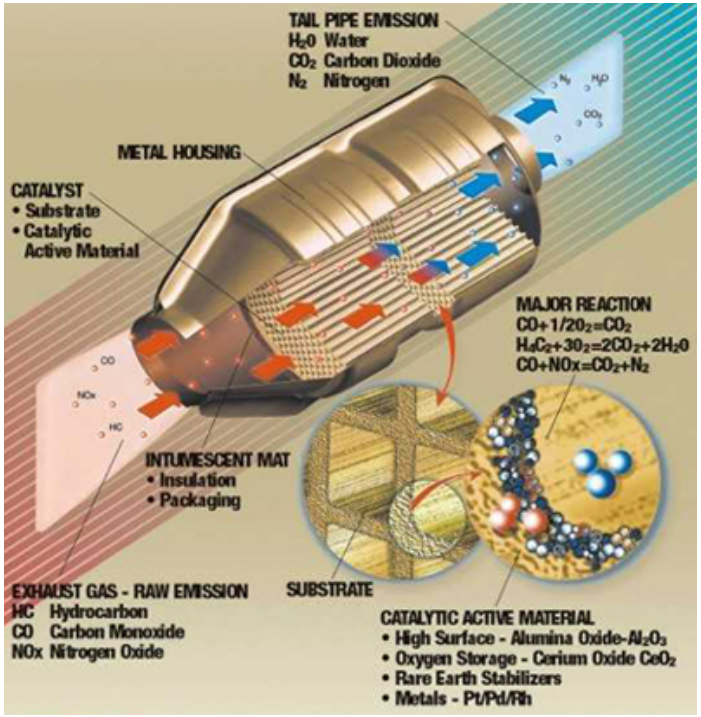
http://www.preciousmetals.umicore.com/recyclables/SAC/CatalyticConverter/

Currently available technologies

Engine	 <u>Positive ignition</u> (typically, gasoline)	 <u>Compression ignition</u> (typically, diesel)		
Technology	3-way catalysts	Lean NO_x traps	SCR with ammonia	SCR with hydrocarbons
Features	- Combustion in the motor uses only the necessary amount oxygen. - Simultaneous removal of NO_x, CO and HC. - Very efficient. - Does not work in excess of oxygen (lean-burn conditions).	- 2 cycles: 1) NO_x are "trapped" in the catalyst; 2) Conditions in the exhaust stream are changed to reduced the NO_x. - Not very used by automobiles constructors.	- Most widely used. - Additonal investment with storing and dosing Adblue®/DEF. - Risk of ammonia slip.	- Uses HC from the exhaust to reduce NO_x. - Still requires technological improvements.

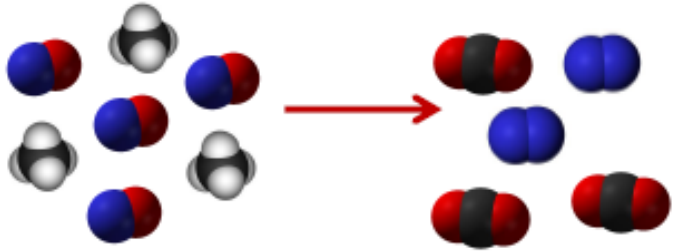
Selective Caltalytic Reduction of Now with unburned methane

- Objectives of the project



http://www.automotivecatalysts.umicore.com/en/autoCatsWebProduct/autoCatsWebGasolineCatalyts/

$$NO + HC + O_2 \rightarrow N_2 + CO_2 + H_2O$$



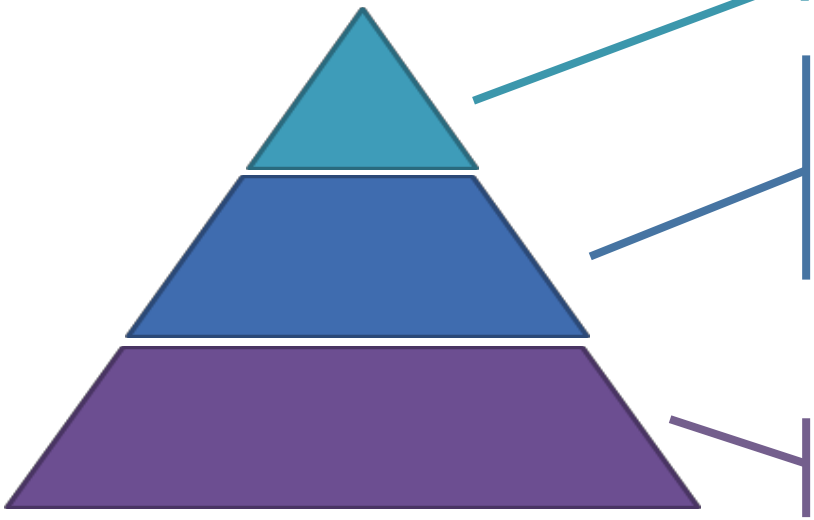
excess of oxygen (lean-burn conditions)

<u>This project</u>:

- To develop and optimise a catalytic **formulation** with potential to be used as a commercial application

Objectives of the project

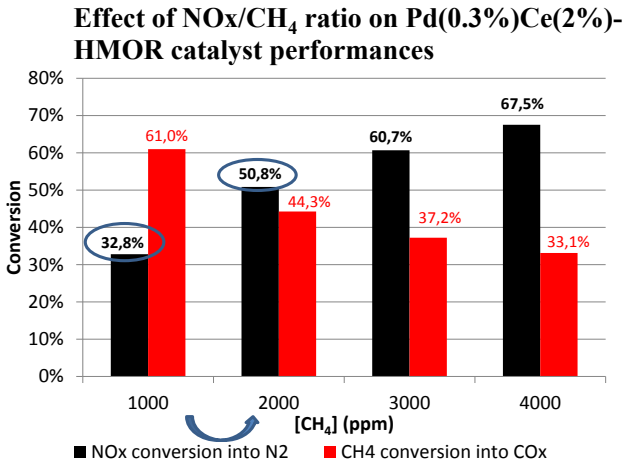
- **Promote the development of an efficient post-treatment system able to promote the CNG chain**



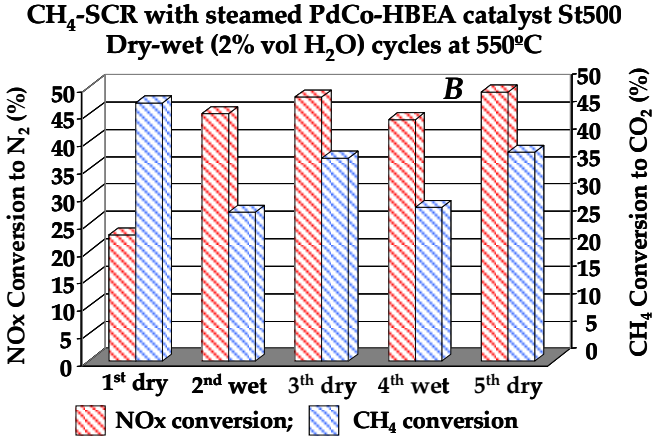
- To improve the competitiveness of lean-burn NGV engines.
- To develop an original and efficient depollution system for lean-burn NGV engines, capable of simultaneous eliminating NO_x and CH_4 (NO_x SCR-CH_4).
- Development of a technology with potential to industrialisation and commercialisation.
- To develop an active, selective and stable catalyst (support + active phase) and to optimise its formulation.

SCR-CH4 : A promoting technolgogy – some results

- **Zeolite based catalysts presented very interesting performances for NOx reduction by methane specially in absence of water**



- Doubling the CH_4 content in the reaction mixture, leads to a significant improvement of NOx conversion from 32.8% to 50.8%



- Water presence seems to lead to a reactivation of the catalyst active sites

- Innovative pre-treatment leading to the system stability even in real conditions (presence of water)

** A.P. Ferreira, C. Henriques, M.F. Ribeiro, F.R. Ribeiro, Catalysis Today 107–108 (2005) 181–191*

Conclusions

- For current and future standards (Euro 6), new vehicles equipped with lean combustion engines have to integrate an additional NOx efficient post-treatment system

- DeNOx-CH_4 as a very interesting solution for exhaust gas treatment issue from natural gas combustion under lean conditions
  - Mobile sources: Natural gas lean burn engines and Dual-fuel applications

Acknowledgements

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