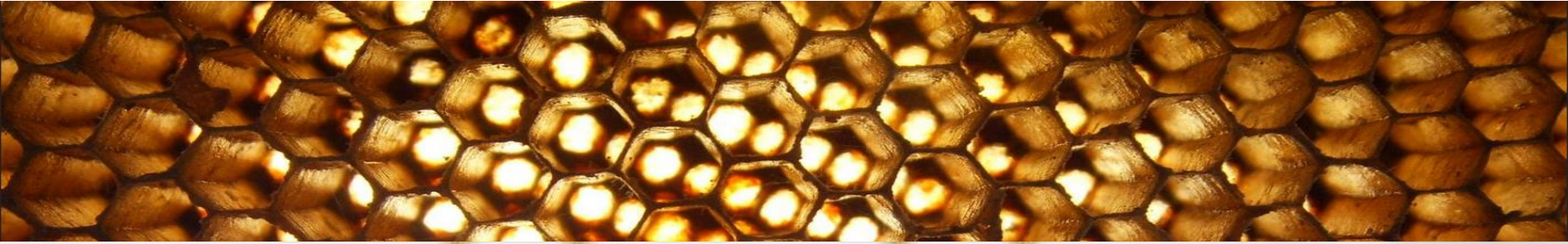


Low Temperature Oxidation Catalyst



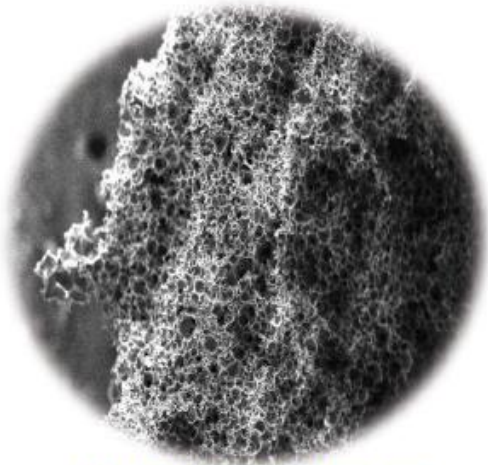
ADVANCED MATERIALS FOR EMISSION CONTROL

Developing advanced materials for emission control and other
cleantech applications



The science and technology of air purification

Nanotechnology for **cleaner air**



Metallic nanoclusters

Our discovery allows the assembly of few atoms of gold forming a specific configuration of clusters with around 1nm in particle size. These configurations present extraordinary and often **unique catalytic performance for oxidising other molecules at ambient conditions.**



room temperature removal



SOOT

low temperature combustion

A mission

To **improve air quality** in the world...



To **reduce health effects** of air pollution in people...

To **create value** and make a difference.





Pollution is a major global concern and latest reports alert on how pollutants affect human health. Formaldehyde, Benzene, styrene and other volatile organic compounds are known human potential carcinogen. Long term exposure to these chemicals may cause damage to the liver, kidneys and/or the central nervous system. Unfortunately VOCs are present in our homes and offices; i.e., released from manufactured products: solvents, glue, paints, etc.

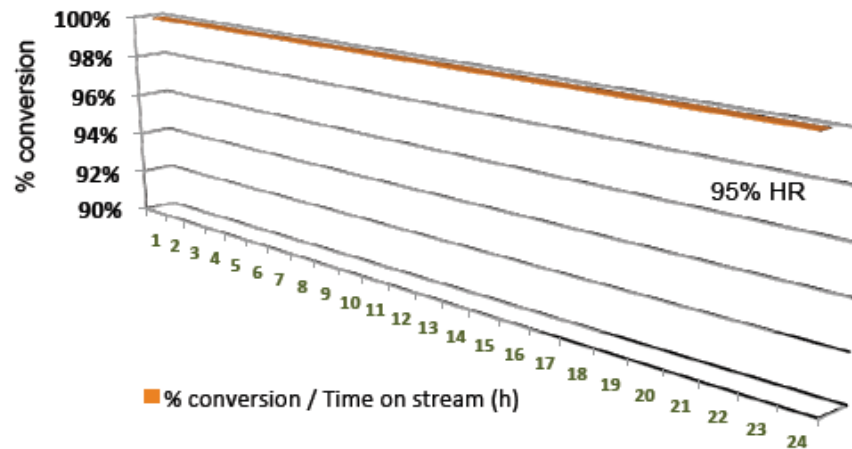
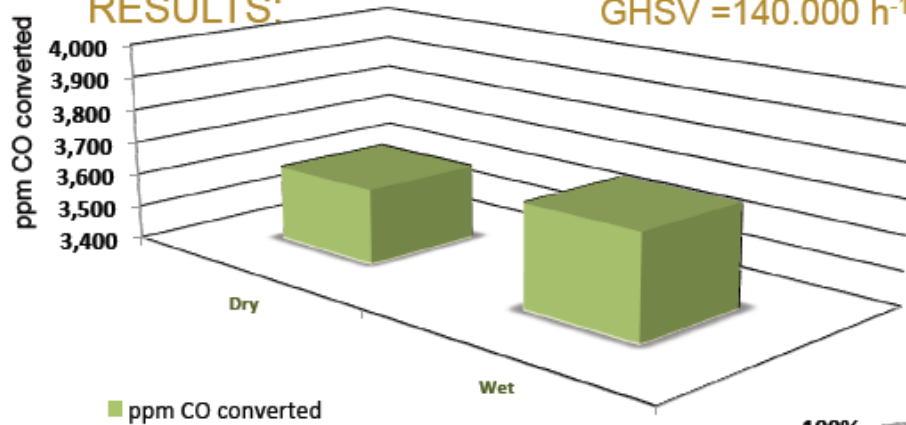
PRODUCT CAPABILITIES:

- Total oxidation of **VOC** emissions at the room temperature to CO_2 and H_2O
- Removing **formaldehyde** emissions already at the room temperature
- Removing **CO** emissions already at the room temperature
- Reducing **NO_x** emissions already at the room temperature
- Removes **H₂** from room temperature
- Not aging like Carbon active filters
- No need of **UV** light.
- No toxic by-products

ELIMINATION OF CO

TEST RESULTS:

Test: 3.700 ppm CO in air,
GHSV = 140.000 h⁻¹, room temperature

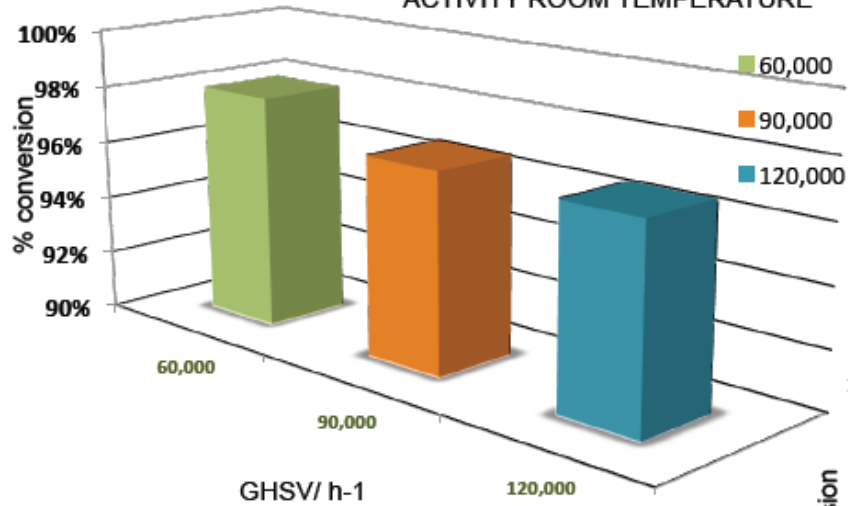


ELIMINATION OF CO

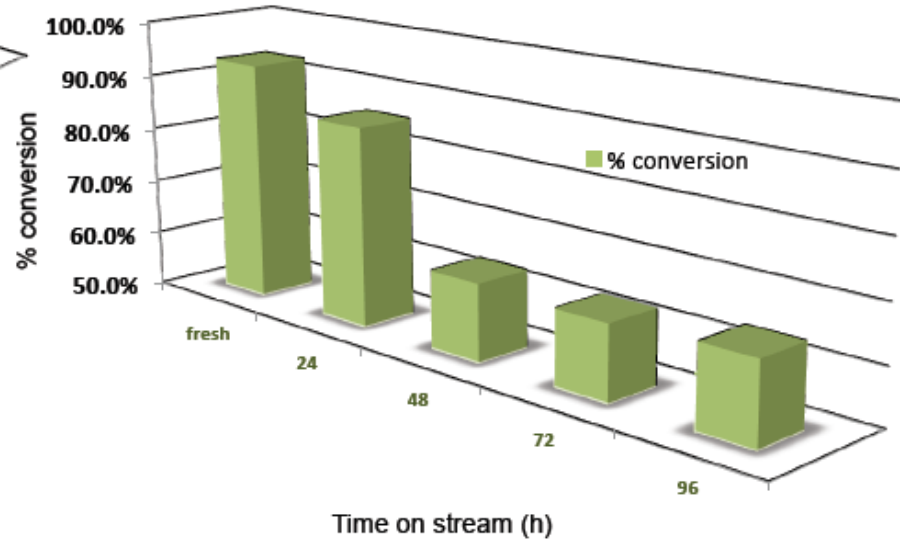
TEST RESULTS:

Test challenge: 20.000 ppm CO in air

ACTIVITY ROOM TEMPERATURE



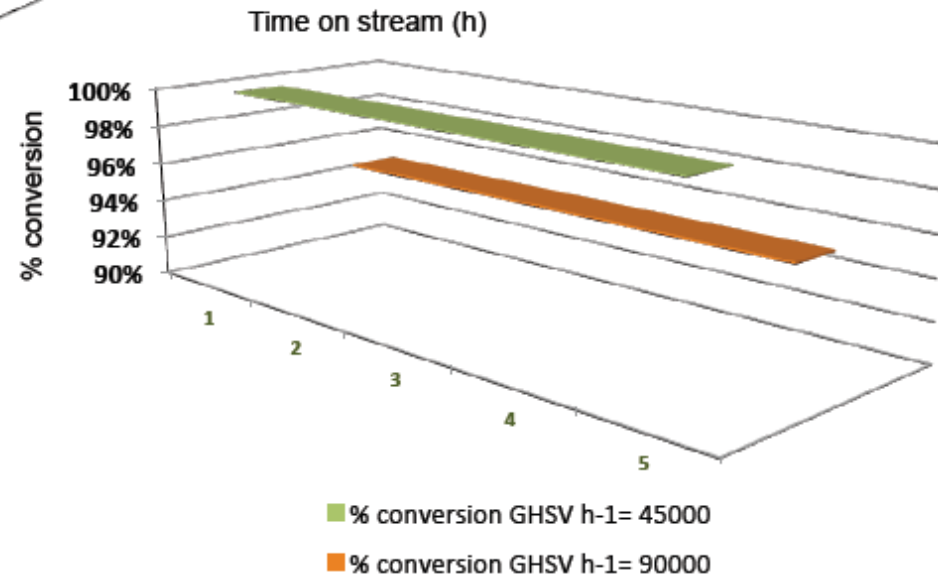
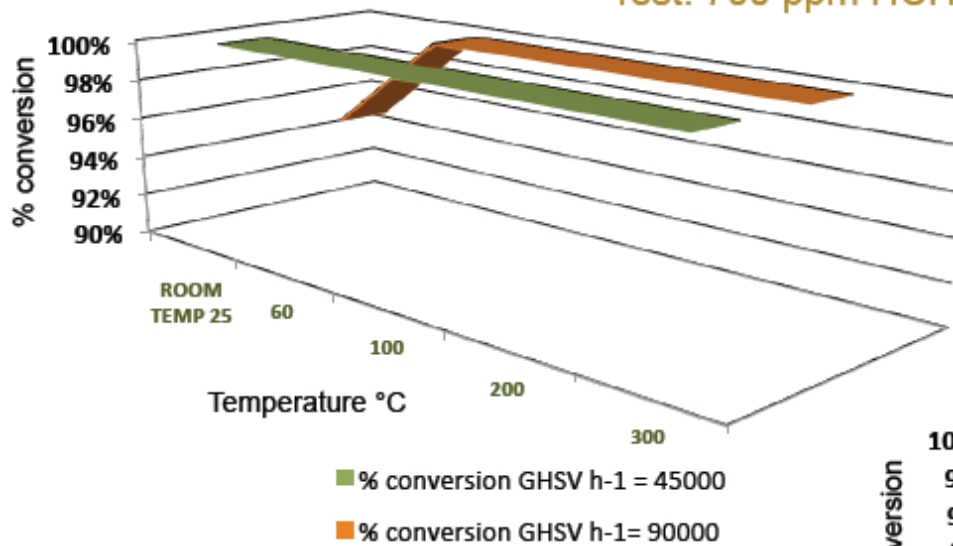
STABILITY ON STREAM AT ROOM TEMPERATURE



ELIMINATION OF FORMALDEHYDE

TEST RESULTS:

Test: 700 ppm HCHO in air at different GHSV



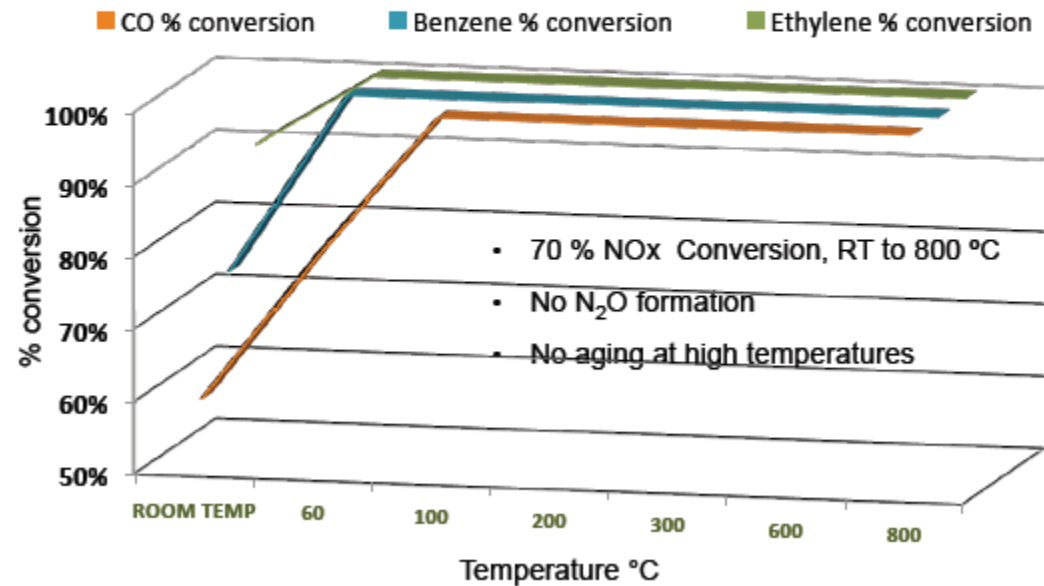
NO BY-PRODUCT FORMATION !!!
TOTAL CONVERSION TO CO₂ AND H₂O

MIXTURES OF POLLUTANTS

TEST

RESULTS: Exhaust emissions from motor vehicles, GHSV = 100.000h⁻¹

Feed composition (wt.%)	
Oxidative conditions	
Element	Concentration
CO	130 ppm
HC's	40 ppm
NOx	100 ppm
RH %	3,66%
O2	12,70%
N2	83,64%



SOOT OXIDATION

Thermal decomposition of a model soot (carbon black, printex U) mixed with different gold loadings

Catalyst	Thermal decomposition			
Au loading / wt. %	T _{initial} (°C)	T _{maximum} (°C)	T _{final} (°C)	CO ₂ /CO ratio
0	530	635	654	0.95
0,1	394	412	568	2.0
0.3	349	397	467	3.0
0.5	262	304	443	3.0
1.5	331	491	529	2.5

- Gold is significantly beneficial for decreasing the oxidation temperature of soot
- 0.5 wt.% of gold reduces ignition temperature down about 260 °C

CONCLUSIONS

- Low temperature oxidation catalyst have an interesting combination of properties for air purification in submarine environments.
- Operation at room temperature for:
 - CO oxidation
 - VOC removal (benzene, formaldehyde, toluene, ethylene,...)
 - H₂ removal
- Low temperature oxidation of carbonaceous particles
- The catalyst has been demonstrated to be stable for months and upon degradation and it can be regenerated using a simple thermal treatment
- Upon our knowledge we have the highest oxidation catalytic activity
- We are ready to prepare a tailor made catalyst