Technology Readiness Level: 4
Component and/or Breadboard Validation in Laboratory Environment

**Eltron Research & Development**

**Tech Brief**

# Catalytic Coatings for Removal of Soot from Gas Turbine Exhausts

## THE TECHNOLOGY

- ***Description:*** Proprietary catalytic coating
- ***Effective:*** ~40% removal of soot from diesel engine exhaust at 550$^o$C
- ***Inexpensive:*** <$5/lb material
- ***Easily applied:*** Coating can be applied by slurry, liquid phase, spray, and other methods
- ***Can operate under moderate conditions:*** Down to 400ºC
- ***Highly robust:*** Coating material has been used in $H_2S$ fuel cell with >3% $H_2S$ at 1000$^o$C
- ***Unreactive:*** Material does not react with alumina or $ZrO_2$
- ***Flexibility of use:*** Material has been applied to metal (fecralloy) and ceramic surfaces

Eltron Research & Development Inc. is addressing the development of catalytic coatings and a process for applying them to the internal surfaces of gas turbine engines for the purpose of reducing soot and other emissions from turbine exhausts without compromising engine performance (via induced pressure drop). Such coatings are based on materials discovered at Eltron that possess soot and VOC oxidation activity at moderate temperatures.

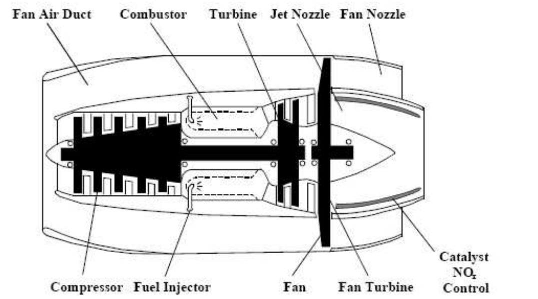



Figure 1. Schematic of turbofan engine showing placement of the desooting catalyst in the nozzle throat, one possible location for the catalyst.

The materials will be applied to surfaces using selected (e.g., plasma and spray deposition) techniques. The resulting coatings will add only a few grams of weight to a full-scale propulsion platform and produce no additional pressure drop. Thus far, catalyst compositions have been identified that promote the complete oxidation of even graphitized carbon at temperatures as low as 400℃. In addition, at least two methods have been identified for depositing the catalyst material on engine alloy and thermal barrier coating surfaces. One of these methods allows the formation of the catalytic film *in situ* by first applying a thin film of precursor, followed by decomposing the film to the active metal oxide while the engine is running.

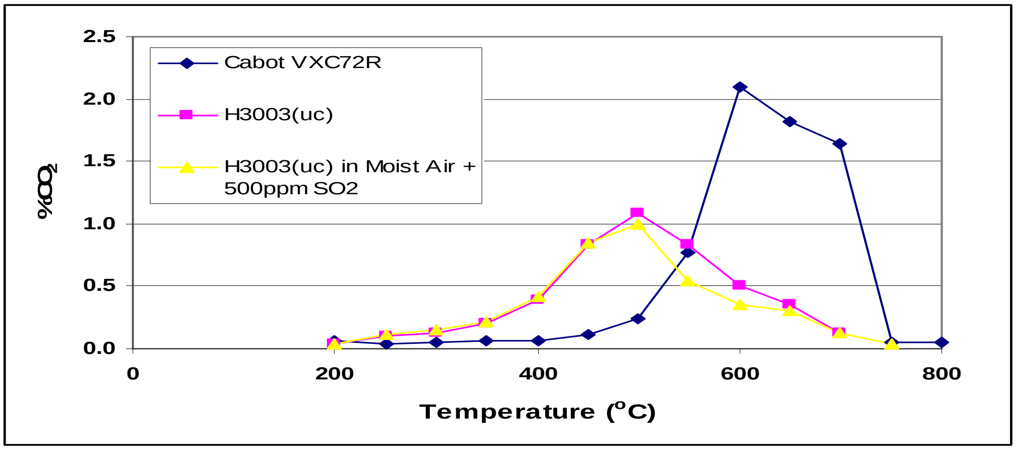
Data obtained is summarized in **Table 1**. The percentage soot destroyed was computed as the difference between soot deposited on the collection filter with no monolith and that deposited with a monolith in place.

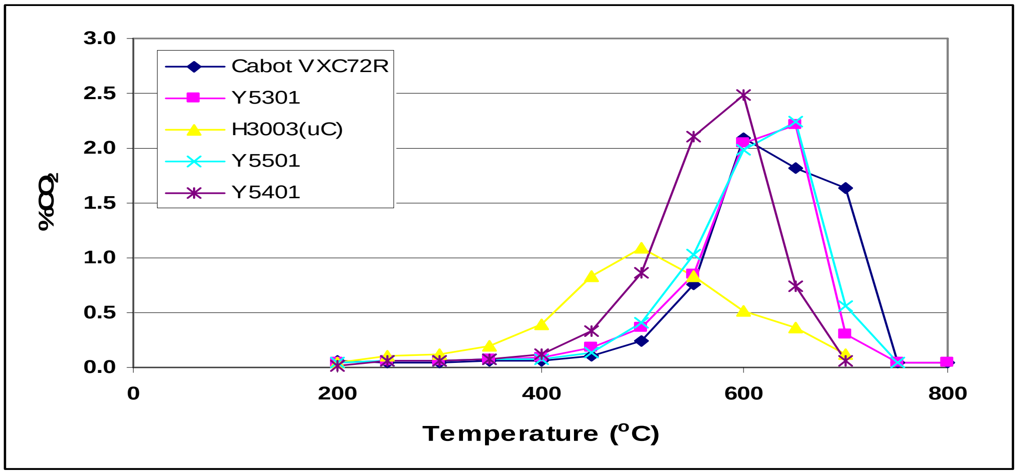
**Table 1.**
**Summary of Diesel Exhaust Soot Abatement Data Obtained with Fecralloy Monoliths Coated with Preferred Catalyst**

| Description | Soot Deposited (g) | Volatiles Deposited (g) | Soot Destroyed (%) |
|---|---|---|---|
| No Monolith | 0.52 | 0.04 | - |
| Catalyst/$H_2O$ Slurry | 0.32 | 0.06 | 38.5 |
| Catalyst/Liquid | 0.325 | 0.045 | 37.5 |

Results strongly suggest that films deposited by both slurry and liquid phase methods can catalyze the destruction of soot in a real exhaust. Consequently, this taken together with previous bench top experiments suggest that key chemical and materials issues associated with the approach can be fully resolved. It is anticipated that the inclusion of low levels of certain metals can further enhance the activity of catalytic films.

Out of the total 25 catalyst candidates Eltron has tested with these methods, peak carbon oxidation was obtained at temperatures as low as 450°C. The graphs below show plots of percent $CO_2$ in reactor exhaust for screening runs of coprecipitated, uncalcined preferred catalyst (H3003(uc)) in dry air and in moist air (3 vol% $H_2O$) with 500 ppm $SO_2$.




## Contact Us

To discuss the possibility of entering into a business relationship with Eltron, contact the Business Development Group at business@eltronresearch.com.

To learn more about Eltron Research & Development and the many technologies that the company is researching and commercializing, visit www.eltronresearch.com.

Eltron Research & Development

**Eltron Research & Development Inc.**
Eltron Research & Development Inc. commercializes novel technologies involving advanced materials, energy, water and environmental systems.




4600 Nautilus Court South | Boulder, CO 80301 | Phone: 303.530.0263 | www.eltronresearch.com