

## Platinum – Palladium Alloy Pt:Pd 2:1

### Technology Differentiation

- Enhanced metal to metal contact at nanometer scale improving oxidation resistance and thermal stability.

### How

- Rational Catalyst Design
  - Provides guidance understanding nanoparticle stability and reactivity.
  - Proprietary synthesis technology produces mixed-metal composite particles

### Key Benefit

- Precious Metal Cost Savings – 20-30% over Industry's Pt-only formulations; match performance at lower cost
- Alternatively, exceed performance at equal precious metal cost

### Target Applications

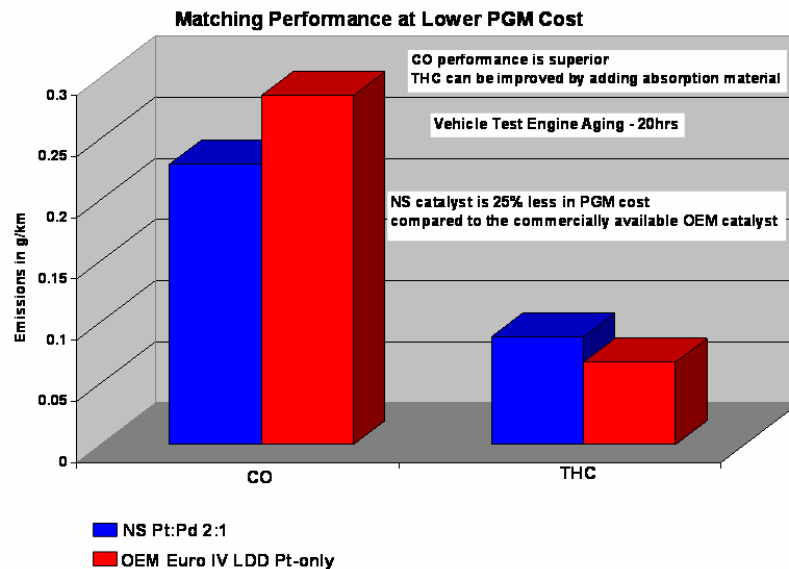
- Applications requiring high temperature stability with excellent low temperature performance. e.g. Light Duty Diesel Vehicles

### Features and Supportive Data

- Cost Effective Pt:Pd ratio 2:1
- Significantly enhanced hydrothermal stability versus Pt-only catalysts (Fig. 1, 2, 3)
- Low temperature CO/HC light-off (Fig. 4)
- NO oxidation is comparable to Pt after high temperature aging (Fig.5)
- Higher Pt:Pd ratios available for enhanced NO oxidation
- Tolerance to sulfur poisoning

### Manufacturing and Supply Flexibility

- Available on various alumina supports
- Can be tailor made on your preferred support material



**Fig 1.** THC and CO bag emissions; Vehicle MVEG Test. The catalysts were engine aged for 20 hours using a two mode cycle with fuel injection used to reach maximum temperatures of ~ 650 °C. The OEM catalyst contains HC absorption components (NS Pt:Pd does not). NS catalyst performance can be enhanced by use of hydrocarbon absorption materials.

**Rational Design combines computational approaches with scientific experience and experimental methodologies in order to accelerate the development of new materials.**

**Nanostellar<sup>®</sup> specializes in Rational Catalyst Design with emphasis in the fields of quantum computational nanoscience, chemistry, materials science, and chemical engineering.**

**Nanostellar's unique combination of algorithms, software, synthesis processes, and testing methodologies enables the rapid development of novel heterogeneous catalysts, thus reducing R&D cost.**

### Equal PGM Cost Comparison

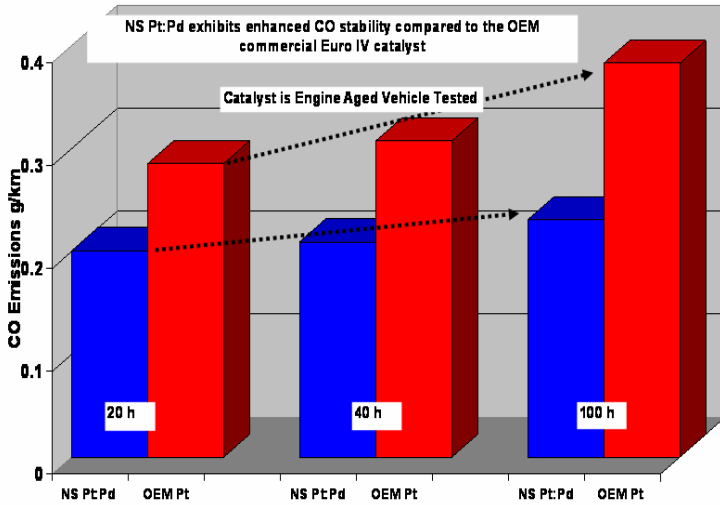


Fig 2. CO bag emissions; Vehicle MVEG Test; The catalysts were engine aged for 20, 40 and 100 hour using a two mode cycle with fuel injection used to reach maximum temperatures of ~ 650 °C.

### Equal PGM Cost Comparison

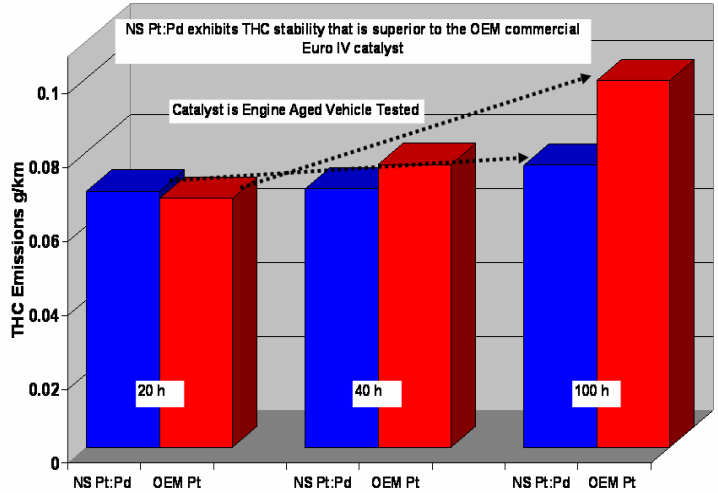


Fig 3. THC bag emissions; Vehicle MVEG Test. The catalysts were engine aged for 20, 40 and 100 hours using a two mode cycle with fuel injection used to reach maximum temperatures of ~ 650 °C. The OEM catalyst contains HC absorption components (NS Pt:Pd does not). NS catalyst performance can be enhanced by use of hydrocarbon absorption materials.

### Aging Effect on CO and HC Light-Off

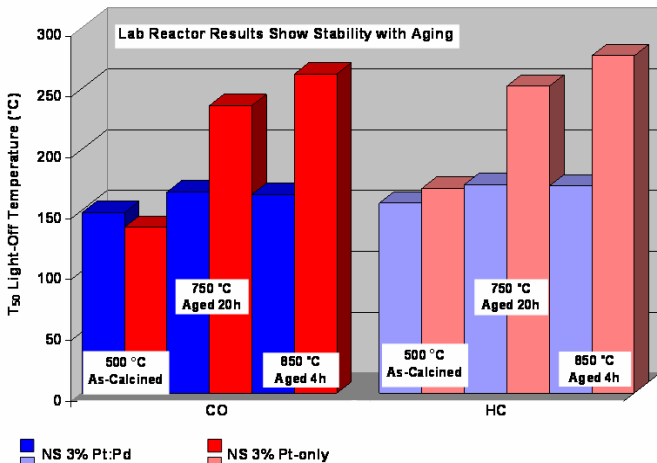


Fig 4. CO & HC Light-Off Temperature; Lab reactor testing. The catalysts were aged in 10% H<sub>2</sub>O/Air.

### Effect of Aging on NO Conversion

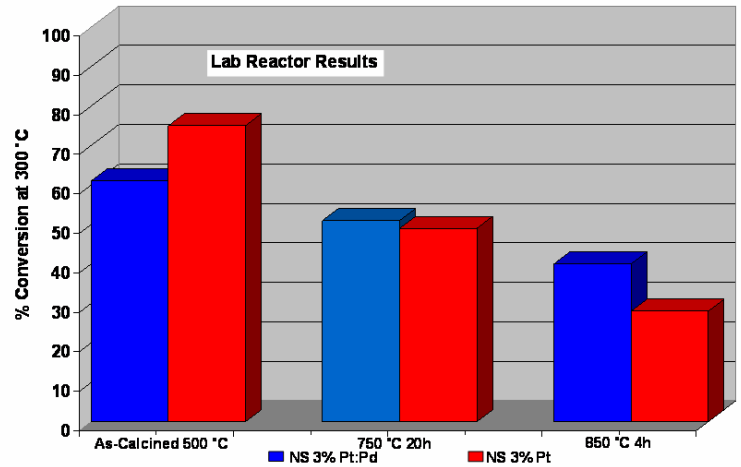


Fig 5. NO conversion at 300 °C; Lab reactor testing. The catalysts were aged in 10% H<sub>2</sub>O/Air.

### CONTACT INFORMATION:

**NANOSTELLAR, INC.**  
**3696 HAVEN AVENUE**  
**REDWOOD CITY, CA 94063**

**TEL: (650) - 368 - 1010**  
**FAX: (650) - 368 - 1011**  
[WWW.NANOSTELLAR.COM](http://WWW.NANOSTELLAR.COM)

[BYAVUZ@NANOSTELLAR.COM](mailto:BYAVUZ@NANOSTELLAR.COM)

The information presented by Nanostellar concerning the composition, properties and use of its products and services is believed by Nanostellar to its best knowledge to be reliable and accurate. However, none of the literature and other material concerning any product or service or its selection or use should be construed as Nanostellar's providing warranty of any kind for its products and services. Nanostellar hereby expressly disclaims Warranties of Merchantability, Fitness for a Particular Purpose, and Non-Infringement for its products and services. All sales are subject to Nanostellar's Terms and Conditions of Sale, which is printed on the invoice. Remedies for any breach and Nanostellar's liability, including that for patent infringement, are limited as provided in Nanostellar's Terms and Conditions of Sale. Nanostellar is not liable for consequential, incidental, or special damages. Nothing should be construed as a recommendation or inducement to infringe any patent. No assumption should be made that all safety or environmental protection measures are indicated, or that other measures may not be required.