



NS Gold™

Technology Differentiation

- Introducing gold for diesel emission control and other lean stream applications

How

- Rational Catalyst Design
 - Provides guidance to enhanced understanding of Au, Pt, and Pd metal-metal interactions and of the metal-support interface for achieving improved nanoparticle stability and reactivity.
 - Proprietary synthesis technology produces mixed-metal composite particles

Key Benefit

- Comparable performance to Pt:Pd 2:1 technology at lower PGM cost
- High performance alternative to Pt:Pd formulations offering similar stability and cost

Target Applications

- DOC, hydrocarbon and ammonia slip, VOC, natural gas exhaust and other lean applications

Features and Supportive Data

- Enhanced hydrocarbon oxidation activity (15-20+% improvement from Pt:Pd)
- Allows a wide range of catalyst system engineering
- Tri-metal system allows flexibility in cost-performance targets with PGM market fluctuations
- Engineering design around catalytic oxidation of NO to NO₂ - Low NO₂ formation rate

Manufacturing and Supply Flexibility

- Available on various commercial and proprietary base metal oxide materials

**All Catalysts are at Equal Cost
Relative Cost Basis
Pt:Pd:Au 4:1:2**

NS Gold™ CO Comparison

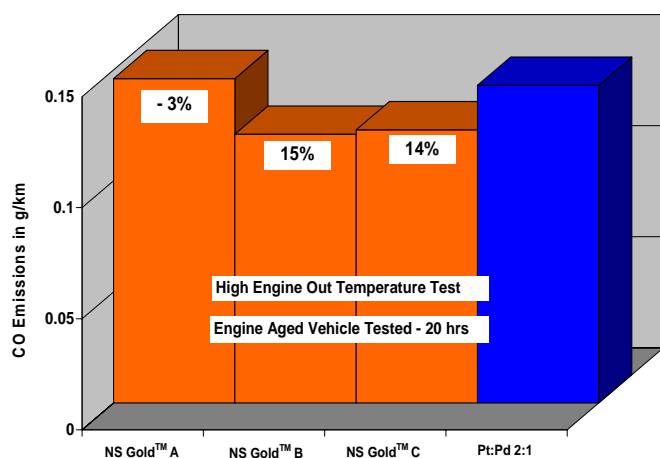


Fig 1. CO bag emissions at three separate catalyst system strategies; High engine-out temperature test; Vehicle MVEG Test; The catalysts were engine aged for 20 hours using a two mode cycle with fuel injection used to reach maximum temperatures of ~ 650 °C. Catalysts were formulated without HC absorption components.

NS Gold™ THC Comparison

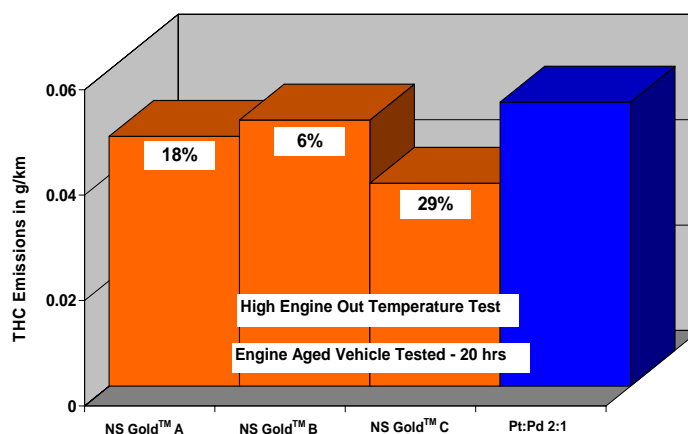


Fig 2. THC bag emissions at three separate catalyst system strategies; High engine-out temperature test; Vehicle MVEG Test; The catalysts were engine aged for 20 hours using a two mode cycle with fuel injection used to reach maximum temperatures of ~ 650 °C. Catalysts were formulated without HC absorption components.

Rational Design combines computational approaches with scientific experience and targeted experiments in order to accelerate the development of new materials.

Nanostellar® 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 methods enables the rapid development of novel heterogeneous catalysts, thus reducing R&D cost.

Nanostellar® is a leader in Rational Catalyst Design with 50 man-years of experience.

NS Gold™ Improves THC Performance
(in a broad range of engine operating temperatures)

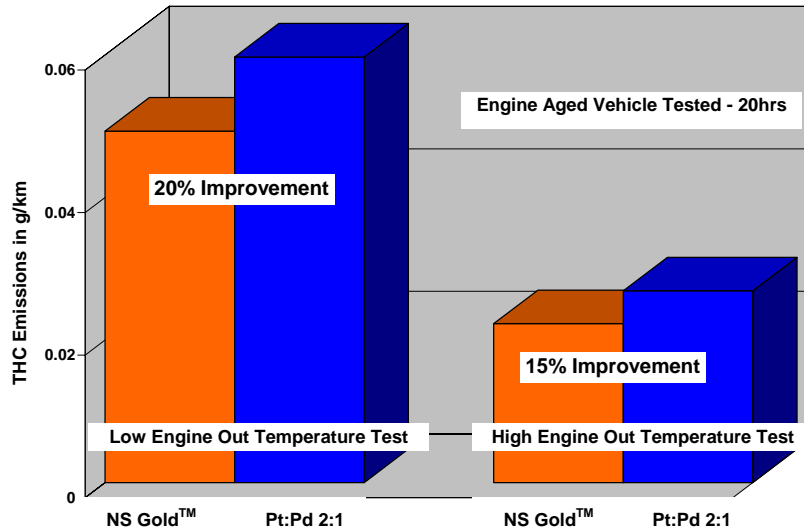


Fig 3. THC bag emissions; Vehicle MVEG Tests conducted at high and low engine-out temperatures; The catalysts were engine aged for 20 hours using a two mode cycle with fuel injection used to reach maximum temperatures of ~ 650 °C. Each catalyst was formulated with an equal amount of HC absorption material.

NS Gold™ has Equal CO Performance

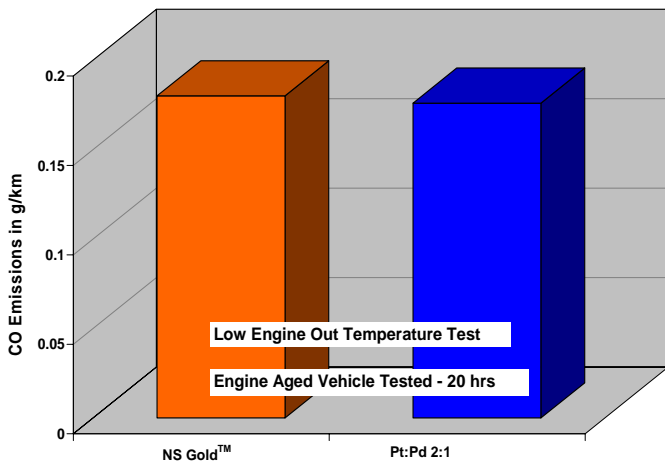


Fig 4. CO bag emissions; Low engine-out temperature test; Vehicle MVEG Test; The catalysts were engine aged for 20 hours using a two mode cycle with fuel injection used to reach maximum temperatures of ~ 650 °C. Each catalyst was formulated with an equal amount of HC absorption material.

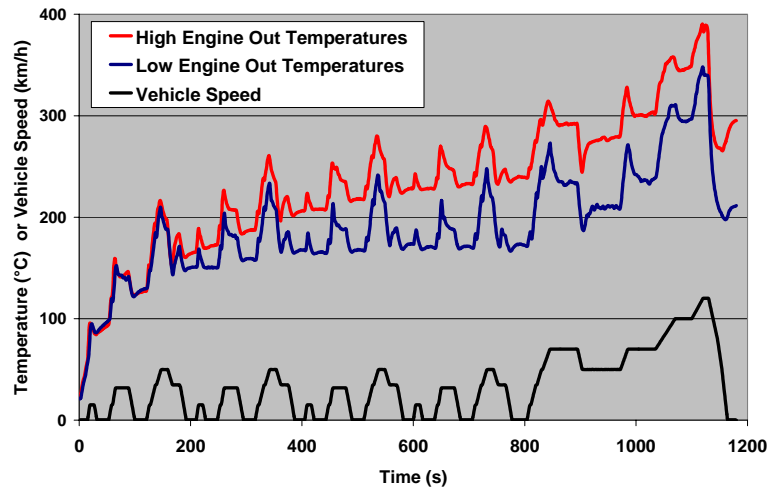


Fig 5. Temperature traces and vehicle speed obtained at low and high engine-out temperature conditions.

CONTACT INFORMATION:

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

TEL: (650) - 368 - 1010
FAX: (650) - 368 - 1011
WWW.NANOSTELLAR.COM

BYAVUZ@NANOSTELLAR.COM

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