# BERKELEY CATALYSIS CENTER

## Distinguished Lecture Series

**Nov 13, 2003**
**The McCollum Room**
**775-A Tan Hall**
**3:30-4:30 pm**


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# NOx Trap R&D for Diesel and Gasoline Lean-Burn Emission Control Applications


*ABSTRACT:*

Most vehicles on the road today utilize closed-loop, stoichiometric air-fuel control and a three-way catalyst system. Such systems are capable of extremely good emissions control, but lack the capability to control NOx emissions under fuel-lean conditions, where the best fuel economy is realized. Serious research efforts have been underway since about 1990 on catalyst development for lean-burn vehicles – initially on selective catalytic reduction of NOx, and more recently on NOx trapping systems. The trapping approach is predicated on the realization that, even if it is not feasible to continuously convert NOx under lean conditions, it should be possible to trap or store NOx under lean conditions and then periodically convert it during brief periods of stoichiometric or slightly rich engine operation. This is indeed the case, and such systems, incorporating alkali or alkaline earth oxides as storage agents, are now starting to see limited commercial use.

My talk will provide an overview of the key technical challenges in implementing NOx trap technology. Simply put, the major challenges are cost and durability. The high cost of LNTs relates directly to the large volume of trapping material and precious metals (platinum and rhodium) required at the current level of technology. Moreover, the performance of current LNTs degrades significantly with time in service. Our work, combined with studies by other groups, has provided a generalized concept of how NOx traps function. Our emphasis at Ford has been mostly on durability issues, since much of the cost associated with current traps results from over-design required to maintain sufficient activity in the face of roughly ten-fold loss in storage effectiveness with time-in-service. We have identified major deactivation modes associated with Pt particle coarsening and barium leaching.

Finally, I will touch on the need for industry-university collaborations in an era of shrinking "R" in industrial R&D. The Ford Research and Advanced Engineering has identified the University of California-Berkeley as a preferred partner for such collaborations. To this end, we believe that research projects with the Berkeley Catalysis Center can provide opportunities for breakthroughs in emission catalysis not readily available either in-house or through our catalyst suppliers.