

# BERKELEY CATALYSIS CENTER

## Seminar

November 11, 2005  
The McCollum Room  
775A Tan Hall  
2 pm

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“From the internal combustion engine to the fuel cell:  
Moving towards the hydrogen economy”

### *ABSTRACT:*

The control of carbon monoxide, hydrocarbons and nitric oxides emitted from the gasoline internal combustion engine has been achieved using the catalytic converter present in the automobile exhaust. The three way catalytic converter (TWC), first introduced in 1980, is currently used throughout the world significantly reducing emissions. The desire for enhanced fuel economy and lower emission of greenhouse gases has suggested the need for new modes of engine operation. We are now seeing the emergence of hybrid engines (internal combustion engines in combination with batteries) and significantly improved lean-burn engines (i.e. diesel) both of which address these needs but there are new challenges to be met. Although progress continues to be made in new internal combustion engine technologies the world is moving towards fuel cells which utilize hydrogen and oxygen to power the future.

The fuel cell converts chemical energy ( $H_2$  and  $O_2$ ) directly to electricity and heat avoiding the thermodynamic limitations imposed by the Carnot Cycle greatly improving efficiency. Since no combustion is required no primary pollutants are formed. Furthermore  $CO_2$  emissions are greatly reduced or could be eliminated completely dependent on the source of the hydrogen. Finally we can envision an ideal hydrogen economy in which hydrogen derived from natural energy sources such as the sun, wind and/or geothermal is used as a source of power. Therefore there is a growing interest in fuel cells and hydrogen generation research. Most major automobile companies are demonstrating fuel cell vehicles. We are also beginning to see fuel cells replacing batteries in portable power applications. The first generation of fuel cell systems for combined heat and power for residential use are rapidly under development in many parts of the world. Let us not forget that the fuel cell is the main power source for space vehicles.

Today's seminar will present the state of the art in catalytic emission control from the internal combustion engine and some of the catalytic challenges being addressed in the development of fuel cells for the hydrogen economy.