

U.S. DEPARTMENT OF ENERGY  
OFFICE OF FOSSIL ENERGY  
NATIONAL ENERGY TECHNOLOGY LABORATORY



## EMBEDDED OPTICAL SENSORS FOR THERMAL BARRIER COATINGS

### Description

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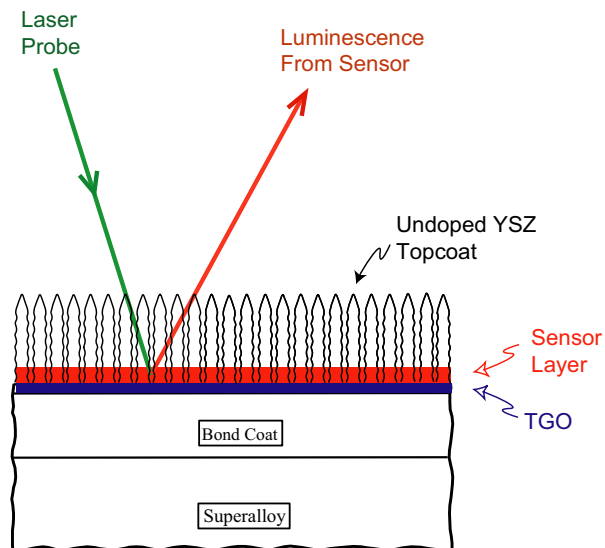
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The objective of the program is to develop a class of optical sensing methods for monitoring thermal barrier coatings based on the luminescence properties of dopants incorporated within the crystal structure of the thermal barrier coating itself. The program is focused on the two principal commercial thermal barrier coating materials, yttria-stabilized zirconia and gadolinium zirconate. In the first part of the program, selection of candidate luminescent dopants and thermal stability will be assessed. In later stages, sensors will be fabricated and demonstrated in a combustion environment.



*Schematic of a "red-line" luminescence sensor for assessing wear and local temperature measurement in a thermal barrier coating.*



**PROJECT COST**

\$200,000

**PROJECT DURATION**

09/01/2003 – 08/30/2006

**WEBSITES**

[www.netl.doe.gov/coal](http://www.netl.doe.gov/coal)

**Accomplishments**

The program has only recently begun but already coating materials have been successfully doped with candidate rare-earth dopants and their room temperature luminescence characterized as a function of concentration.

This characterization stage will continue for the next six months and the thermal stability assessed in thermal cycling tests. Concurrently, the fabrication of simple sensor structures will be attempted with the objective of demonstrating the first coating sensor deposited by electron beam deposition by the end of the year.