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N95-26122

THERMAL BARRIER COATINGS ISSUES IN ADVANCED  
LAND-BASED GAS TURBINES

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The Department of Energy's Advanced Turbine System (ATS) program is aimed at fostering the development of a new generation of land-based gas turbine systems with overall efficiencies significantly beyond those of current state-of-the-art machines, as well as greatly increased times between inspection and refurbishment, improved environmental impact, and decreased cost. The proposed duty cycle of ATS turbines will require the use of different criteria in the design of the materials for the critical hot gas path components. In particular, thermal barrier coatings will be an essential feature of the hot gas path components in these machines. While such coatings are routinely used in high-performance aircraft engines and are becoming established in land-based turbines, the requirements of the ATS turbine application are sufficiently different that significant improvements in thermal barrier coating technology will be necessary. In particular, it appears that thermal barrier coatings will have to function on all airfoil sections of the first stage vanes and blades to provide the significant temperature reduction required. In contrast, such coatings applied to the blades and vanes of advanced aircraft engines are intended primarily to reduce air cooling requirements and extend component lifetime; failure of those coatings can be tolerated without jeopardizing mechanical or corrosion performance. A major difference is that in ATS turbines these components will be totally reliant on thermal barrier coatings which will, therefore, need to be highly reliable even over the leading edges of first stage blades. Obviously, the ATS program provides a very challenging opportunity for TBCs, and involves some significant opportunities to extend this technology.