PROJECT facts

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

High Efficiency Engines and Turbines

12/2002

ROTATING AND STATIONARY RECTANGULAR COOLING PASSAGE HEAT TRANSFER AND FRICTION WITH TURBULATORS AND DIMPLES

PRIMARY PROJECT PARTNER

Texas A&M University

TOTAL ESTIMATED COST

$ 238,630

CUSTOMER SERVICE

800-553-7681

STRATEGIC CENTER FOR NATURAL GAS WEBSITE

www.netl.doe.gov/scng

Description

Under the Advanced Gas Turbine Systems Research (AGTSR) program, Texas A&M is evaluating internal cooling associated with gas turbines. Task 1 obtains heat transfer and pressure drop data for representative rotor cooling channels with a range of rectangular cross sectional areas. Task 2 obtains detailed flow and local heat transfer data in stationary channels for a range of coolant-to-wall temperature ratios. Both of the tasks will conduct tests using various channel aspect ratios and with smooth and dimpled surfaces and with pins and turbulators to enhance cooling effectiveness. Task 3 uses computer computations to predict the effects of rotation for the conditions of the stationary passage tests. The computer analyses will also predict the effects of high rotating buoyancy parameters and high Reynolds numbers on rotor cooling heat transfer related to real engine conditions.

As shown by project data (Figure 1), dimples can significantly improve cooling effectiveness (indicated by local Nusselt numbers) at the surfaces of rectangular cooling channels.

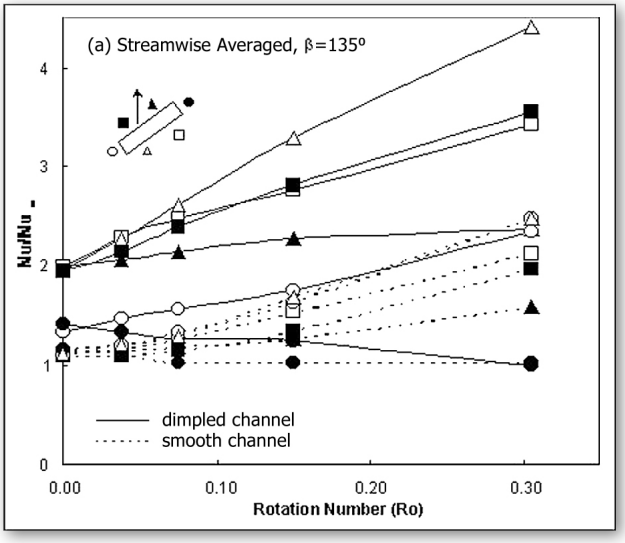

Figure 1. Enhanced cooling for dimples on rotating rectangular cooling channels

Rotating and Stationary Rectangular Cooling Passage Heat Transfer and Friction with Turbulators and Dimples

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Duration

24 months

Goals

The project experimentally and computationally evaluates parameters and design aspects associated with internal cooling of turbine components.

Benefits

The stationary and rotating experimental and computational results will provide turbine engineers with new data for design of airfoil internal rectangular cooling passages and thereby improve the cooling efficiency and thermal efficiency of gas turbines.