PROCEEDINGS OF ECOS 2014 - THE 27TH INTERNATIONAL CONFERENCEON
EFFICIENCY, COST, OPTIMIZATION, SIMULATION AND ENVIRONMENTAL IMPACT OF ENERGY SYSTEMS
JUNE15-19, 2014, TURKU, FINLAND

CFD of a ceramic axial gas turbine with porous cooling

Emiliano Sansonne, Fabio Ciccateri, Matteo Piacentini and Simone Certelli

[a] *La Sapienza, Rome,Italy , Sans_rm@hotmail.it*

Abstract:

The gas turbine's efficiency increases with the turbine inlet temperature: advanced gas turbine engines operate today at very high temperatures (1500–2000K). As the temperature increases, the heat transferred to the turbine blade increases too, so that the operational life of the standard blade material is limited. For this reason, we present in this paper a study of a steel blade coated with porous ceramic that can sustain high temperatures without experiencing excessive creep and keeping an high mechanical resistance, internal air obviously needed, with the cooling. Air extracted from the high-pressure compressor stages. This air passes through properly arranged small holes in the metallic core of the blade and then it diffuses inside the porous ceramic coat. In this preliminary study we search for the minimum amount of coolant that ensures a prescribed maximum material temperature in the blade with the maximum possible uniformity and without excessively affecting the blade aerodynamic performance. Several injection/diffusion geometries were numerically simulated, and since the aim of this paper is to present and discuss a model of porous ceramic blade cooling, a simple blade shape was adopted (no twist and no bend).

Keywords:
gas turbine, ceramic blade, cooling.