World Academy of Science, Engineering and Technology
International Journal of Mechanical and Materials Engineering
Vol:11, No:12, 2017

Analysis of Thermal Damage Characteristics of High Pressure Turbine Blade According to Off-Design Operating Conditions

Authors : Seon Ho Kim, Minho Bang, Seok Min Choi, Young Moon Lee, Dong Kwan Kim, Hyung Hee Cho

Abstract : Gas turbines are heat engines that convert chemical energy into electrical energy through mechanical energy. Since their high energy density per unit volume and low pollutant emissions, gas turbines are classified as clean energy. In order to obtain better performance, the turbine inlet temperature of the current gas turbine is operated at about 1600℃, and thermal damage is a very serious problem. Especially, these thermal damages are more prominent in off-design conditions than in design conditions. In this study, the thermal damage characteristics of high temperature components of a gas turbine made of a single crystal material are studied numerically for the off-design operating conditions. The target gas turbine is configured as a reheat cycle and is operated in peak load operation mode, not normal operation. In particular, the target gas turbine features a lot of low-load operation. In this study, a commercial code, ANSYS 18.2, was used for analyzing the thermal-flow coupling problems. As a result, the flow separation phenomenon on the pressure side due to the flow reduction was remarkable at the off-design condition, and the high heat transfer coefficient at the upper end of the suction surface due to the tip leakage flow was appeared.

Keywords : gas turbine, single crystal blade, off-design, thermal analysis
Conference Title : ICTETA 2017 : International Conference on Thermal Engineering Theory and Applications
Conference Location : Paris, France
Conference Dates : December 28-29, 2017