This paper presents the optimization of curvilinear fiber paths of laminated composite plates with circular cutouts intending to maximize the buckling load. High fidelity model responses are performed using ANSYS Composite PrepPost and the surrogate model and the optimization algorithm are implemented in the R platform [3]. The results showed that the buckling load was improved substantially when compared to constant-stiffness composites parts subjected to the same conditions. Also, the proposed framework showed a reduction in the final computational burden compared to direct high-fidelity model optimization.

[1] C.S. Lopes, Z. Gürdal and P.P. Camanho, Compos. Part A: Appl. S., 41, 1760 (2010).
[2] D.R. Jones, J. Global Optim., 21, 345 (2001).
[3] O. Roustant, D. David and Y. Deville, J. Stat. Softw., 51, 1 (2012).

ACEX275

Ms. Gisele Fabiane Costa Almeida
Instituto de Pesquisas Energéticas e Nucleares,
São Paulo-SP, Brasil

The Influence of Plasma Nitriding on the Creep Behavior of Ti-6Al-4V Alloy

G.F.C. Almeida1, A.A. Couto1,2, D.A.P. Reis3, M. Massi3, A.S. da Silva Sobrinho4, N.B. Lima1
1Instituto de Pesquisas Energéticas e Nucleares, São Paulo-SP, Brasil.
2Universidade Presbiteriana Mackenzie, São Paulo-SP, Brasil
3Universidade Federal de São Paulo, São José dos Campos-SP, Brasil.
4Instituto Tecnológico de Aeronáutica, Depart. de Física, São José dos Campos-SP, Brasil.

Titanium and its alloys are excellent materials for applications at elevated temperatures, since the Ti-6Al-4V alloy is the most important. This alloy has been widely used in the aerospace industry, mainly for applications that requiring high temperature strength [1,2]. The aim of this work is try to improve the creep resistance of Ti-6Al-4V alloy using a surface treatment by plasma nitriding. The nitriding was performed by varying parameters as time, temperature and the nitrogen content in the gas atmosphere. The nitriding time ranged from 4 to 6 hours at temperatures between 720 and 770ºC. A nitrogen-argon mixture, with a small part of hydrogen, was utilized in order to determine the best conditions for the formation of the nitride layer. Microstructural characterization of the nitrided layer was performed by optical microscopy (OM), scanning electron microscopy (SEM) and X-ray diffraction (XRD). Subsequently, creep tests were performed on the material in the best condition. The phases of the nitrided samples detected by X-ray diffraction were e-Ti2N phase and d-TiN, in addition to the α-Ti and β-Ti phases matrix, wich appeared in all samples. In the case of the treated sample with 50% nitrogen in the gas atmosphere was chosen as the best condition, the increase of the relative intensities of the peaks assigned to e-Ti2N and d-TiN phases and the decrease of those assigned to α-phase indicates a larger thickness, the layer thickness of this sample was about 12mm. The results of creep resistance of nitrided material shows decreased in the secundary creep rate and longer time to rupture compared to the material without treatment.

[1] Evans RW, Wilshire B. Introduction to creep. The Institute of Materials; 1993.
[2] NORRIS G. Feeling the heat. Met Bull Mon. 1994; v. 386:p. 36–39.

ACEX350

Dr. Tomasz Rzychoń
Silesian University of Technology,
Faculty of Materials Engineering and Metallurgy
40-019 Katowice, ul. Krasińskiego 8, Poland