Oxidation of superalloys - Spectroscopic study of the various forms of alumina (transition and alpha / thermal and synthetic).

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Code CCP 6

Communications Affichées

Introduction & Objectives:

The ferritic alloy PM2000 have been the subject of many investigations because of their commercial importance and scientific interest, widely used in combustion parts for engines, parts in aeronautics, parts for the construction of high-temperature furnaces, components for the chemical plant construction, and pull rod assemblies for high temperature testing [1].Their resistance capability is due, among other things, to the fact that they develop at high temperature a fine layer of highly protective alumina. During the recent development and research, Al_2O_3 has become an indispensable material to these areas due to its superior mechanical, chemical and thermal properties. Through oxidation, this oxide film acts as a diffusion barrier while keeping a good adherence. Before reaching the most stable alumina, the old alumina materials develop the transition aluminas, the most common of which are the γ, δ and / or θ phase. The protection of superalloys against high-temperature oxidation is ensured by the development of a protective phase (dense and continuous) of α-alumina on the surface of the alloy (rich in aluminum).

Results and Discussion:

1-Photoluminescence spectroscopy

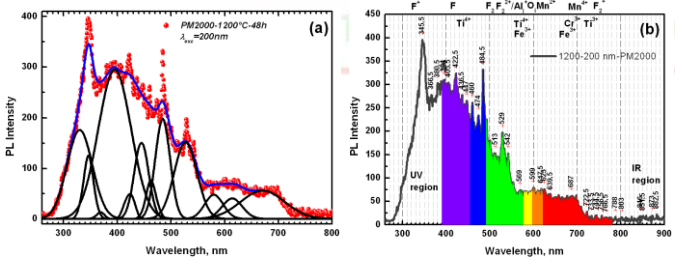

Fig. (a) PL of PM2000 alloys axidized at 1200°C (48h) with an excitation wavelength 200 nm, mù^m*ùmland (b) the corresponding intrinsic and/or extrinsic defects [2].

2-Raman spectroscopy

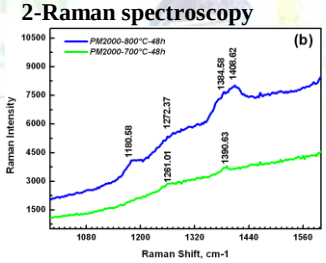

Fig. Raman spectra of the PM2000 ,(b) oxidised at 700 and 800°C (48h) [3].

Conclusion: The aim of our work was demonstrate if spectroscopic analysis could give complementary information to commonly used techniques such as X-ray diffraction and SEM analyses and observations. SEM and FEG analyzes and observations allowed to characterize the various stages of the formation of the oxides since 600 ° C, and up to 1200 ° C treated under air during 48h. Demonstrating the presence of elements Fe, Cr, and Al in the early stages of oxidation, and then the formation of transition aluminas, particularly the gamma phase, then the theta phase, and finally the formation of alpha alumina

Keywords: PM2000, transition alumina, alpha alumina, Raman, Photoluminescence spectroscopy.

References

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