EFFECT OF RARE EARTH CE/LA ADDITION ON THE MICROSTRUCTURE AND HARDNESS OF NICKEL- BASED SUPERALLOY INCONEL 718

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Superalloy Inconel 718 is employed in aeronautic/aerospace engines, nuclear and chemical industries due to its high oxidation resistance and excellent mechanical properties at elevated temperatures. In recent years, research on the effects of rare earths in superalloys has made important advances, the use of elements like: rhenium, hafnium, tantalum, niobium, ruthenium has increased to obtain higher properties. Researchers have reported that elements such as yttrium and cerium have positive effects on the mechanical properties at elevated temperatures due hardening mechanism by solid solution, as well as in modifications of carbides and eutectic phases. However, the use of Ce/La in superalloys has not been satisfactorily explored although studies indicate that they are elements with high potential to improve the mechanical and microstructural properties. The nanostructured Inconel 718 modified with traces Ce/La addition was processed by mechanical alloying (MA). The Inconel 718 was used with the mixture of (Ce/La- 50/50) to form alloys with contents of 0.1, 0.2 and 0.3 wt% of Ce/La. The powders were milling for 5h o in a high- energy mill Spex- 8000. The milling device and milling media used were made from hardened steel. All millings runs were performed with N- heptane as process control agent and argon as an inert milling atmosphere. Powder mass 8.5 g and a ball- to- powder ratio of 5:1 were used. The compaction of the powders was carried out in a hydraulic press under a compaction pressure of 1.56 GPa for 5 minutes. The sintering process was realized at 1300ºC for 3h in vacuum sealed quartz ampoules. The structural and microstructural characterization was carried out by a Panalytical X´Pert- PRO x- ray diffractometer and scanning electron microscope HITACHI- SU3500. Vickers microhardness was evaluated in LM300- AT tester. Inconel 718 present a homogeneous and refined microstructure composed for oxides, carbides and Delta- precipitates (Ni_3Nb) with acicular morphology homogeneously distributed. It was observed that higher amounts of Ce/La content in Inconel 718 promoted the refinement of the rounded particles, additionally favored the increments in HV values in sintered, solubilized and aged conditions. The peaks of hardness were obtained in Inconel 718 with 0.2 Ce/La (wt. %).

Keywords: Rare- earth, Superalloy, Hardness

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