the addition of Re to INCONEL can improve the precipitation behavior of ÿ', which in turn improves the high temperature resistance of the alloy.

The heat treatment temperature is a critical factor in the microstructural evolution and in mechanical properties of INCONEL rhenium superalloys. The proper temperature of heat treatment can lead to an optimized microstructure and superior properties over time that inappropriate heat treatment temperatures can cause adverse effects. Optimizing the heat treatment temperature is essential to achieve the properties desired for specific applications.

The heat treatment temperature range for INCONEL superalloys with Re is between 700 and 1200 °C, depending on the specific composition of the alloy and the desired properties. This temperature range is used for the precipitation of the ÿ' phase, which can improve creep strength and alloy hardness.

Optical microscopy of sample P5 after homogenization annealing reveals a structure fine granular solid solution ÿ. The grain boundaries appear bright, with some noticeable grouping of precipitated phases, but without being able to precisely establish their nature.

Hardness after homogenization annealing does not decrease much (from 378 HV02 in the state cast, at 367 HV02 in homogenized state), confirming also from this point of view that the homogenization was not total.

The higher degree of alloying of the P4 alloy changed the structure of the material, even the ratio between the phase constituents ÿ and ÿ', so that in this case the majority constituent is ÿ'. The elongated, filiform, bright shapes found in this sample belong to the LAVES phases, and the increased density can be attributed to the appearance of Mo in the chemical composition, an element which frequently it can form LAVES phases in INCONEL type alloys.

In addition to improving the mechanical properties of INCONEL alloys, the addition of Re it can also substantially increase their corrosion resistance, especially in aggressive environments.

From the analysis of Tafel curves and corrosion parameters, the following aspects emerge:

- All the curves have very high anodic slopes, which indicates the passivation tendency of the materials;
- The corrosion potentials of the P2-P5 alloys are practically identical, differences of a few tens of mV;

7.2 Original Contributions

Realization of a complex bibliographic study on superalloys.

Elaboration and casting in an electric vacuum induction furnace and argon atmosphere of five types of Inconel alloys, with original chemical composition, of which 4 with variable content of

- The design of a heat treatment technology of elaborated superalloys, which a including normalizing annealing, solution quenching, aging and explanation the structural phenomena that occur after each stage;
- Evaluation of hardness variation of worked superalloys by gauges after working and after each heat treatment operation.
- Structural analysis by optical microscopy of superalloys after elaboration and after homogenization annealing heat treatments, solution quenching and getting older.
- Structural and compositional analysis by scanning electron microscopy (SEM) associated with characteristic X-ray energy dispersive spectroscopy (EDS) a elaborated superalloys, after casting and homogenization annealing thermal treatments, solution hardening and aging.
- Analysis of corrosion parameters in H_2SO_4 solution.

7.3 Future directions of scientific research

- Development in vacuum and argon atmosphere of six nickel base superalloys with different chemical compositions;
- The influence of the degree of undercooling and the content of hard fusible elements (Re, W, Ta) on the homogeneity of the structure obtained after casting with directed solidification;
- The influence of Mo content on the formation of Laves phases.

In this way, comparative studies can be carried out on the possibility of improving a physical-mechanical properties and corrosion resistance.

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