Patent application WO2021/250545 relates to a method for manufacturing a slab made of an aluminum alloy for vacuum chamber elements, valves or complete assemblies, the method comprising the steps of: (a) providing a feedstock material for rolling an Al-Mg-Si aluminum alloy having a composition comprising, in % by weight, Mg 0.80% - 1.05%, Si 0.70% - 1.0%, Mn 0.70% - 0.90%, Fe up to 0.20%, Zn up to 0.08%, Cu up to 0.05%, Cr up to 0.03%, Ti up to 0.06%, unavoidable impurities and the remainder being aluminum; (b) homogenizing the rolling feedstock at a temperature within a range from 550 to 595°C; (c) hot rolling the homogenized rolling feedstock in one or more rolling step(s) into a hot-rolled slab having a thickness of at least 10 mm; (d) solution heat treatment of the hot-rolled plate at a temperature within a range from 540 to 590°C; (e) rapid cooling of the solution heat-treated slab; (f) controlled stretching by a permanent elongation of 1 to 5% of the solution heat-treated and cooled slab; (g) artificial aging of the stretched slab.

There is a need for products made of an aluminum alloy intended for making vacuum chamber elements, having sufficient mechanical characteristics, an improved dimensional stability for the machining steps as well as an optimum ability to create oxide layers with high chemical resistance.

Summary

An aspect of the disclosure is a method for manufacturing a plate having a final thickness comprised between 6 and 50 mm, wherein

a) a rolling slab is cast in an aluminum alloy having the following composition, in weight %, Si: 0.6 – 1.3; Mg: 0.6 – 1.2; Mn: 0.65 – 1.0; Fe: 0.04 – 0.20; Cr ≤ 0.05; Ti ≤ 0.15; Cu ≤ 0.1; other elements < 0.05 each and < 0.15 in total, the remainder being aluminum,

b) said rolling slab is homogenized,

c) said rolling slab is rolled with an entry temperature of at least 500°C to obtain a plate with a thickness at least equal to 8 mm,

d) optionally, out an annealing is carried out,

e) the hot-rolled and optionally annealed plate is cold rolled with a reduction of at least 20%,

f) the cold-rolled plate is solution heat treated and quenched,

g) said solution heat-treated and quenched plate is stress relieved by controlled stretching with a permanent elongation of 1 to 5%,

h) said stretched plate carrying is artificially aged,

i) optionally said aged plate is machined.

Another aspect of the disclosure is a plate obtainable by the method according to the disclosure.

Still another aspect of the disclosure is the use of a plate according to the disclosure for making a vacuum chamber element.

Figures

[Fig. 1] Figure 1 illustrates the measurement of residual stresses.

Detailed description of the invention

The designation of the alloys is done in accordance with the regulations of The Aluminum Association (AA), known to a person skilled in the art. The definitions of the metallurgical tempers are indicated in the European standard EN 515. Unless stated otherwise, the definitions of the standard EN12258-1 apply.

Unless stated otherwise, the compositions are expressed in % by weight.

Unless stated otherwise, the static mechanical characteristics, in other words the ultimate tensile strength R_m, the conventional tensile yield strength at 0.2% elongation $R_{p0.2}$ and the elongation at break A%, are determined by a tensile test according to the standard ISO 6892-1, the sampling and the direction of the test being defined by the standard EN 485-1, the direction or orientation L corresponds to the lengthwise direction with respect to the main rolling direction and the direction or orientation LT corresponds to the long transverse direction.

In the context of the present invention, the residual stresses have been determined using the bar method based on the successive removal of layers described in particular in the publication "Development of New Alloy for Distortion Free Machined Aluminum Aircraft Components", F. Heymes, B. Commet, B. Dubost, P. Lassince, P. Lequeu, GM. Raynaud, in 1st International Non-Ferrous Processing & Technology Conference, 10-12 March 1997 – Adams's Mark Hotel, St Louis, Missouri and in patent applications WO2004/053180 or WO2006/064113.

This method applies especially to substantially stretched plates, in which the stress state could be considered to be homogeneous in the sampling area of the bars and biaxial; the two main components being located in the directions L and LT, and there is therefore no component in the direction ST. This method is based on the determination of the deflections of two rectangular bars, cut across the thickness of the plate in the direction parallel to the directions L and LT. These bars are machined in the direction ST step-by-step. After each step, the deformation and/or the detection is measured and the thickness of the bar is reported. In the context of the