These documents do not mention the problem of improving the resistance to creep deformation at high temperature.

There is a need for further improved vacuum chamber elements, particularly in terms of resistance to creep deformation at high temperature, while maintaining high properties of corrosion resistance, homogeneity of properties in thickness and machinability.

Summary

In one aspect, the present disclosure refers to a vacuum chamber element obtained by machining and surface treatment of a plate of thickness at least equal to 10 mm made of aluminium alloy composed as follows (as percentages by weight), Si: 0.4 - 0.7, Mg: 0.4 - 1.0; the Mg/Si ratio as a percentage by weight being less than 1.8; Ti: 0.01 - 0.15, Fe 0.08 - 0.25; Cu <0.35; Mn <0.4; Cr: <0.25; Zn <0.04; other elements <0.05 each and <0.15 in total, the rest aluminium, characterized in that the grain size of said plate is such that the mean linear intercept length $\bar{\ell}$, measured in plane L/TC according to standard ASTM E112, is at least equal to 350 μm between surface and ½ thickness.

In another aspect, the present disclosure refers to a method of manufacturing a vacuum chamber element wherein successively

a. an aluminium alloy rolling slab is cast, of composition (as percentages by weight) Si: 0.4 - 0.7, Mg: 0.4 - 1.0; the Mg/Si ratio as a percentage by weight being less than 1.8; Ti: 0.01 - 0.15, Fe 0.08 - 0.25; Cu <0.35; Mn <0.4; Cr: 0.25 - 0.04; other elements < 0.05 each and < 0.15 in total, the rest aluminium,
b. optionally, said rolling slab is homogenized,
c. said rolling slab is rolled at a temperature above 400 °C to obtain a plate having a thickness at least equal to 10 mm,
d. said plate undergoes solution heat treatment, optionally preceded by a cold working operation, and is quenched,
e. after solution heat treatment and quenching, said plate is stress-relieved by controlled stretching with permanent elongation of 1 to 5%,
f. the stretched plate then undergoes ageing,
g. optionally, additional cold working of at least 3% and an annealing treatment at a temperature of at least 500°C are carried out; the annealing treatment can be carried out before or after steps h or i of machining and surface treatment,
h. the aged plate is machined into a vacuum chamber element,
i. surface treatment of the vacuum chamber element obtained in this way, preferably comprising anodization carried out at a temperature of between 10 and 30°C, is performed with a solution comprising 100 to 300 g/l of sulphuric acid and 10 to 30 g/l of oxalic acid and 5 to 30 g/l of at least one polyol,

said method comprising appropriate additional annealing and/or solution heat treatment and/or cold working and/or annealing steps to obtain a grain size such that the average linear intercept length $\bar{\ell}$, measured in plane L/TC according to standard ASTM E112, is at least 350 μm between surface and mid-thickness.

Subject of the invention

The first subject of the invention is a vacuum chamber element obtained by machining and surface treatment of a plate of thickness at least equal to 10 mm made of aluminium alloy composed as follows (as percentages by weight), Si: 0.4 - 0.7, Mg: 0.4 - 1.0; the Mg/Si ratio as a percentage by weight being less than 1.8; Ti: 0.01 - 0.15, Fe 0.08 - 0.25; Cu <0.35; Mn <0.4; Cr: <0.25; Zn <0.04; other elements <0.05 each and <0.15 in total, the rest aluminium, characterized in that the grain size of said plate is such that the mean linear intercept length $\bar{\ell}$, measured in plane L/TC measured according to standard ASTM E112 , is at least equal to 350 μm between surface and mid-thickness.

The second subject of the invention is a method of manufacturing a vacuum chamber element in which successively

a. an aluminium alloy rolling slab is cast, of composition (as percentages by weight) Si: 0.4 - 0.7, Mg: 0.4 - 1.0; the Mg/Si ratio as a percentage by weight being less than 1.8; Ti: 0.01 - 0.15, Fe 0.08 - 0.25; Cu <0.35; Mn <0.4; Cr < 0.25; Zn<0.04; other elements < 0.05 each and < 0.15 in total, the rest aluminium,
b. optionally, said rolling slab is homogenized,
c. said rolling slab is rolled at a temperature above 400 °C to obtain a plate having a thickness at least equal to 10 mm,
d. said plate undergoes solution heat treatment, optionally preceded by a cold working operation, and is quenched,
e. after solution heat treatment and quenching, said plate is stress-relieved by controlled stretching with permanent elongation of 1 to 5%,
f. the stretched plate then undergoes ageing,
g. optionally, additional cold working of at least 3% and an annealing treatment at a temperature of at least 500°C are carried out; the annealing