A fine crystallite high-function metal alloy member according to a first embodiment of the present invention comprises a metal alloy containing 5 to 30000 ppm of gadolinium (Gd) in a gold (Au) alloy including a high-purity gold (Au) alloy.

The fine crystallite high-function gold (Au) alloy member according to the first embodiment of the present invention was obtained as following: gadolinium (Gd) was added to a metal alloy containing 99.95% by weight of gold (Au) so that the resultant metal alloy has gadolinium (Gd) content of 500 ppm, and then, the mixture thereof was cast-molded to a thick plate having the widths of 30 mm and 10 mm; and then, this plate was solution-treated, aged, and then roll-processed to a thick plate having the thickness of 0.3 mm.

Next, 500 g-ppm of gadolinium (Gd) was added to a gold alloy comprising 90% by weight of gold (Au) and 10% by weight of silver (Ag), and then, the mixture thereof was cast-molded to a thick plate having the widths of 30 mm and 10 mm; and then, this plate was solution-treated, aged, and then roll-processed to a thick plate having the thickness of 0.3 mm.

Further, 500 g-ppm of gadolinium (Gd) was added to a gold (Au) alloy comprising 50% by weight of gold (Au) and 50% by weight of silver (Ag), and then, the mixture thereof was cast-molded to a thick plate having the widths of 30 mm and 10 mm; and then, this plate was heat-treated, and then roll-proce ssed to a thick plate having the thickness of 0.3 mm.

Lastly, 500 g-ppm of gadolinium (Gd) was added to a gold alloy comprising 10% by weight of gold (Au) and 90% by weight of silver (Ag), and then, the mixture thereof was cast-molded to a thick plate having the widths of 30 mm and 10 mm; and then, this plate was solution-treated, aged, and then roll-processed to a thick plate having the thickness of 0.3 mm.

The foregoing finishing-processed thick plates having the thickness of 0.3 mm were analyzed by the X-ray analysis; and the average crystallite diameters obtained by the Scherrer's equation were 27 nm, 15 nm, 19 nm, and 23 nm, respectively. The crystallite size thereof could be newly adjusted in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m).

Without substantial deterioration of electrical conductivity and Young's modulus, hardness, tensile strength, and 0.2% resisting force could be increased by 2 to 3 times. It was found that also elongation could be increased by 2 to 3 times. Softening point could be increased by 2.3 times. Roll-process could be carried out without heat treatment; and in addition, cross process could be carried out. Furthermore, processability and the various characteristics could be enhanced so that it became possible to balance these characteristics.

These effects could be realized in plates, wires, thin films, and powders.

eminent enhancement of the function characteristics could be seen.

A fine crystallite high-function metal alloy member according to the second embodiment of the present invention comprises a metal alloy containing 5 to 30000 ppm of gadolinium (Gd) in a silver (Ag) alloy including a high-purity silver (Ag) alloy.

The fine crystallite high-function silver (Ag) alloy member according to the second embodiment of the present invention was obtained as following: gadolinium (Gd) was added to a metal alloy containing 99.95% by weight of silver (Ag) so that the resultant metal alloy has gadolinium (Gd) content of 500 ppm, and then, the mixture thereof was cast-molded to a thick plate having the widths of 30 mm and 10 mm; and then, this plate was solution-treated, aged, and then roll-processed to a thick plate having the thickness of 0.3 mm.

Next, 500 g-ppm of gadolinium (Gd) was added to a silver (Ag) alloy comprising 90% by weight of silver (Ag) and 10% by weight of palladium (Pd), and then, the mixture thereof was cast-molded to a thick plate having the widths of 30 mm and 10 mm; and then, this plate was solution-treated, aged, and then roll-processed to a thick plate having the thickness of 0.3 mm.

Further, 500 g-ppm of gadolinium (Gd) was added to a silver (Ag) alloy comprising 50% by weight of silver (Ag) and 50% by weight of palladium (Pd), and then, the mixture thereof was cast-molded to a thick plate having the widths of 30 mm and 10 mm; and then, this plate was heat-treated, and then roll-processed to a thick plate having the thickness of 0.3 mm.

Lastly, 500 g-ppm of gadolinium (Gd) was added to a silver (Ag) alloy comprising 10% by weight of silver (Ag) and 90% by weight of palladium (Pd), and then, the mixture thereof was cast-molded to a thick plate having the widths of 30 mm and 10 mm; and then, this plate was solution-treated, aged, and then roll-processed to a thick plate having the thickness of 0.3 mm.

The foregoing finishing-processed thick plates having the thickness of 0.3 mm were analyzed by the X-ray analysis; and the average crystallite diameters obtained by the Scherrer's equation were 8 nm, 19 nm, 23 nm, and 25 nm, respectively. The crystallite size could be newly adjusted in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m).

Without substantial deterioration of electrical conductivity and Young's modulus, hardness, tensile strength, and 0.2% resisting force could be increased by 2 to 3 times. It was found that also elongation could be increased by 2 to 3 times. Softening point could be increased by 2.2 times. Roll-process could be carried out without heat treatment; and in addition, cross process could be carried out. It was further found that processability was

gadolinium (Gd) was obtained.

When evaluation was done as to the samples of the foregoing silver (Ag) alloy compositions, the same addition effect of gadolinium (Gd) was obtained. After addition of gadolinium (Gd), characteristics with regard to hardness, tensile strength, Young's modulus, and heat resistance were enhanced; and it showed the spring property. This could be easily processed, and workability thereof could be improved. Deterioration of electrical conductivity was hardly observed.

In the silver (Ag) alloy having gadolinium (Gd) contained in the range of 5 to 30000 ppm in a metal alloy that is constituted by silver (Ag) and at least one element selected from the group consisting of rare earth metals other than gadolinium (Gd), alkaline earth metals, zirconium (Zr), tin (Sn), indium (In), copper (Cu), palladium (Pd), aluminum (Al), zinc (Zn), nickel (Ni), and gallium (Ga), eminent enhancement of the characteristics could be seen.

A fine crystallite high-function metal alloy member according to a third embodiment of the present invention comprises a metal alloy containing 5 to 30000 ppm of gadolinium (Gd) in a platinum (Pt) alloy including a high-purity platinum (Pt) alloy.

The fine crystallite high-function platinum (Pt) alloy according to the third embodiment of the present invention was obtained as following: gadolinium (Gd) was added to a metal alloy containing 99.95% by weight of platinum (Pt) so that the resultant metal alloy has gadolinium (Gd) content of 500 ppm, and then, the mixture thereof was cast-molded to a thick plate having the widths of 30 mm and 10 mm; and then, this plate was solution-treated, aged, and then roll-processed to a thick plate having the thickness of 0.3 mm.

Next, 500 g-ppm of gadolinium (Gd) was added to a platinum (Pt) alloy comprising 90% by weight of platinum (Pt) and 10% by weight of palladium (Pd), and then, the mixture thereof was cast-molded to a thick plate having the widths of 30 mm and 10 mm; and then, this plate was solution-treated, aged, and then roll-processed to a thick plate having the thickness of 0.3 mm.

Further, 500 g-ppm of gadolinium (Gd) was added to a platinum (Pt) alloy comprising 50% by weight of platinum (Pt) and 50% by weight of copper (Cu), and then, the mixture thereof was cast-molded to a thick plate having the widths of 30 mm and 10 mm; and then, this plate was heat-treated, and then roll-processed to a thick plate having the thickness of 0.3 mm.

Lastly, 500 g-ppm of gadolinium (Gd) was added to a platinum (Pt) alloy comprising 10% by weight of platinum (Pt) and 90% by weight of copper (Cu), and then, the mixture thereof

thereof is the same as that of the first embodiment.

In any case by the above-mentioned processing method, the addition effect of gadolinium (Gd) could be seen eminently.

The same effect could also be obtained when the solution treatment and the ageing treatment were conducted.

When evaluation was done as to the sample which was prepared by adding 5 to 30000 ppm of gadolinium (Gd) to the palladium (Pd) alloy including a high-purity palladium (Pd) alloy whose crystal lattice is a face-centered cubic lattice, the same addition effect of gadolinium (Gd) was obtained.

When evaluation was done as to the sample of the blended palladium (Pd) alloy having the respective foregoing compositions, the same addition effect of gadolinium (Gd) was obtained.

After addition of gadolinium (Gd), characteristics with regard to hardness, tensile strength, resisting force, heat resistance, and so forth were enhanced; and it showed the spring property. This could be easily processed, and workability thereof could be improved. Deterioration of Young's modulus and electrical conductivity was hardly observed.

In the palladium (Pd) alloy having gadolinium (Gd) contained therein in the range of 5 to 30000 ppm, eminent enhancement of the characteristics and balance characteristics could also be seen.

A fine crystallite high-function metal alloy member according to a fifth embodiment of the present invention comprises a metal alloy containing 5 to 30000 ppm of gadolinium (Gd) in an aluminum (Al) alloy including a high-purity aluminum (Al) alloy.

The fine crystallite high-function aluminum (Al) alloy member according to the fifth embodiment of the present invention was obtained as following: gadolinium (Gd) was added to a metal alloy containing 99.95% by weight of aluminum (Al) so that the resultant metal alloy has gadolinium (Gd) content of 500 ppm, and then, the mixture thereof was cast-molded to a thick plate having the widths of 30 mm and 10 mm; and then, this plate was solution-treated, aged, and then roll-processed to a thick plate having the thickness of 0.3 mm.

Next, 500 g-ppm of gadolinium (Gd) was added to an aluminum (Al) alloy comprising 90% by weight of aluminum (Al) and 10% by weight of magnesium (Mg), and then, the mixture thereof was cast-molded to a thick plate having the widths of 30 mm and 10 mm; and then, this plate was solution-treated, aged, and then roll-processed to a thick plate having the thickness of 0.3 mm.

Further, 500 g-ppm of gadolinium (Gd) was added to an aluminum (Al) alloy comprising 50% by weight of aluminum (Al) and 50% by weight of magnesium (Mg), and then, the mixture thereof was cast-molded to a thick plate having the widths of 30 mm and 10 mm; and then, this plate was heat-treated, and then roll-processed to a thick plate having the thickness of 0.3 mm.

Lastly, 500 g-ppm of gadolinium (Gd) was added to an aluminum (Al) alloy comprising 10% by weight of aluminum (Al) and 90% by weight of magnesium (Mg), and then, the mixture thereof was cast-molded to a thick plate having the widths of 30 mm and 10 mm; and then, this plate was solution-treated, aged, and then roll-processed to a thick plate having the thickness of 0.3 mm.

The foregoing finishing-processed thick plates having the thickness of 0.3 mm were analyzed by the X-ray analysis; and the average crystallite diameters obtained by the Scherrer's equation were 6 nm, 13 nm, 27 nm, and 19 nm, respectively. The crystallite size could be adjusted in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m).

The foregoing finishing-processed thick plates having the thickness of 0.3 mm were analyzed by the X-ray analysis; and the average crystallite diameters obtained by the Scherrer's equation were 8 nm, 13 nm, 27 nm, and 19 nm, respectively. The crystallite size could be adjusted in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m).

Without substantial deterioration of electrical conductivity and Young's modulus, hardness, tensile strength, and 0.2% resisting force could be increased by 2 to 3 times. It was found that also elongation could be increased by 2 to 3 times. Softening point could be increased by 2.4 times. Roll-process could be carried out without heat treatment; and in addition, cross process could be carried out. It was further found that processability was enhanced. These characteristics could be balanced.

The various characteristics could be enhanced so that it became possible to balance these characteristics.

The aluminum (Al) alloy member comprises the aluminum (Al) alloy containing 5 to 30000 ppm of gadolinium (Gd).

In the aluminum (Al) alloy, the solution treatment may be done in the temperature range of 300 to 2000°C, and the ageing treatment may be done in the temperature range of 50 to 450°C. Especially preferable conditions are the temperature range of 500 to 1600°C for

durability, capable of being readily processed, could be obtained.

In any case by the above-mentioned processing method, the addition effect of gadolinium (Gd) could be seen eminently.

The same effect could also be obtained when the solution treatment and the ageing treatment were conducted.

When evaluation was done as to the sample which was prepared by adding 5 to 30000 ppm of gadolinium (Gd) to the magnesium (Mg) alloy including a high-purity magnesium (Mg) alloy whose crystal lattice is a face-centered cubic lattice, the same addition effect of gadolinium (Gd) was obtained.

When evaluation was done as to the sample of the blended magnesium (Mg) alloy having the respective foregoing compositions, the same addition effect of gadolinium (Gd) was obtained.

After addition of gadolinium (Gd), characteristics with regard to hardness, tensile strength, resisting force, elongation, and heat resistance were enhanced; and this could be easily processed, and workability thereof could be improved. Deterioration of Young's modulus and electrical conductivity was hardly observed.

A fine crystallite high-function metal alloy member according to a seventh embodiment of the present invention comprises a metal alloy containing 5 to 30000 ppm of gadolinium (Gd) in a copper (Cu) alloy including a high-purity copper (Cu) alloy.

The fine crystallite high-function copper (Cu) alloy member according to the seventh embodiment of the present invention was obtained as following: gadolinium (Gd) was added to a metal alloy containing 99.95% by weight of copper (Cu) so that the resultant metal alloy has gadolinium (Gd) content of 500 ppm, and then, the mixture thereof was cast-molded to a thick plate having the widths of 30 mm and 10 mm; and then, this plate was solution-treated, aged, and then roll-processed to a thick plate having the thickness of 0.3 mm.

Next, 500 g-ppm of gadolinium (Gd) was added to a copper (Cu) alloy comprising 90% by weight of copper (Cu) and 10% by weight of zinc (Zn), and then, the mixture thereof was cast-molded to a thick plate having the widths of 30 mm and 10 mm; and then, this plate was solution-treated, aged, and then roll-processed to a thick plate having the thickness of 0.3 mm.

Further, 500 g-ppm of gadolinium (Gd) was added to a copper (Cu) alloy comprising 65% by weight of copper (Cu) and 35 by weight of zinc (Zn), and then, the mixture thereof was cast-molded to a thick plate having the widths of 30 mm and 10 mm; and then, this plate was heat-treated, and then roll-processed to a thick plate having the thickness of 0.3 mm.

Lastly, 500 g-ppm of gadolinium (Gd) was added to a copper (Cu) alloy comprising 10% by weight of copper (Cu) and 90% by weight of silver (Ag), and then, the mixture thereof was cast-molded to a thick plate having the widths of 30 mm and 10 mm; and then, this plate was solution-treated, aged, and then roll-processed to a thick plate having the thickness of 0.3 mm.

The foregoing finishing-processed thick plates having the thickness of 0.3 mm were analyzed by the X-ray analysis; and the average crystallite diameters obtained by the Scherrer's equation were 17 nm, 7 nm, 21 nm, and 13 nm, respectively. The crystallite size could be adjusted in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m).

Without substantial deterioration of electrical conductivity and Young's modulus, hardness, tensile strength, and 0.2% resisting force could be increased by 2 to 3 times. It was found that also elongation could be increased by 2 to 3 times. Softening point could be increased by 2.3 times. Roll-process could be carried out without heat treatment; and in addition, cross process could be carried out. It was further found that processability was enhanced. These characteristics could be balanced.

The various characteristics could be enhanced so that it became possible to balance these characteristics.

These effects could be realized in plates, wires, thin films, and powders.

Next, a method for manufacturing the metal alloy member having the afore-mentioned characteristics will be explained.

Firstly, in the case of the cast-molded alloy, the alloy material with the afore-mentioned composition is cast-molded, then, if necessary, the material is solution-treated in which rapid cooling is conducted after heating to a prescribed temperature, and further, if necessary, an ageing treatment is conducted thereafter at a prescribed temperature.

In the case of the processed metal alloy, the alloy material with the afore-mentioned composition is cast-molded, then, if necessary, the material is solution-treated in which rapid cooling is conducted after heating to a prescribed temperature, and then the material is processed to a prescribed form, wherein if necessary, the material is aged before or after this process.

In the copper (Cu) alloy, the solution treatment may be done in the temperature range of 600 to 2500°C, and the ageing treatment may be done in the temperature range of 150 to 850°C. Especially preferable conditions are the temperature range of 600 to 1600°C for the

solution treatment, and the temperature range of 150 to 780°C for the ageing treatment.

It was found that by adding gadolinium (Gd), the member having high function and durability, capable of being readily processed, could be obtained.

In any case by the above-mentioned processing method, the addition effect of gadolinium (Gd) could be seen eminently.

The same effect could also be obtained when the solution treatment and the ageing treatment were conducted.

When evaluation was done as to the sample which was prepared by adding 5 to 30000 ppm of gadolinium (Gd) to the copper (Cu) alloy including a high-purity copper (Cu) alloy whose crystal lattice is a face-centered cubic lattice, the same addition effect of gadolinium (Gd) was obtained.

When evaluation was done as to the sample of the respective copper (Cu) alloy compositions, the same addition effect of gadolinium (Gd) was obtained.

After addition of gadolinium (Gd), characteristics with regard to hardness, tensile strength, resisting force, elongation, and heat resistance were enhanced; and this could be easily processed, and workability thereof could be improved. Deterioration of Young's modulus and electrical conductivity was hardly observed.

A fine crystallite high-function metal alloy member according to an eighth embodiment of the present invention comprises a metal alloy containing 5 to 30000 ppm of gadolinium (Gd) in an iron (Fe) alloy including a high-purity iron (Fe) alloy.

The fine crystallite high-function iron (Fe) alloy member according to the eighth embodiment of the present invention was obtained as following: gadolinium (Gd) was added to a metal alloy containing 99.95% by weight of iron (Fe) so that the resultant metal alloy has gadolinium (Gd) content of 500 ppm, and then, the mixture thereof was cast-molded to a thick plate having the widths of 30 mm and 10 mm; and then, this plate was solution-treated, aged, and then roll-processed to a thick plate having the thickness of 0.3 mm.

Next, 500 g-ppm of gadolinium (Gd) was added to an iron (Fe) alloy comprising 99% by weight of iron (Fe) and 1% by weight of silicon Si, and then, the mixture thereof was cast-molded to a thick plate having the widths of 30 mm and 10 mm; and then, this plate was solution-treated, aged, and then roll-processed to a thick plate having the thickness of 0.3 mm.

Further, 500 g-ppm of gadolinium (Gd) was added to an iron (Fe) alloy comprising 75% by weight of iron (Fe), 17% by weight of nickel Ni, and 8% by weight of aluminum (Al), and then, the mixture thereof was cast-molded to a thick plate having the widths of 30 mm and 10

thick plate having the widths of 30 mm and 10 mm; and then, this plate was solution-treated, aged, and then roll-processed to a thick plate having the thickness of 0.3 mm.

Next, 500 g-ppm of gadolinium (Gd) was added to a titanium (Ti) alloy comprising 99.8% by weight of titanium (Ti) and 0.2% by weight of palladium (Pd), and then, the mixture thereof was cast-molded to a thick plate having the widths of 30 mm and 10 mm; and then, this plate was solution-treated, aged, and then roll-processed to a thick plate having the thickness of 0.3 mm.

The foregoing finishing-processed thick plates having the thickness of 0.3 mm were analyzed by the X-ray analysis; and the average crystallite diameters obtained by the Scherrer's equation were 7 nm, and 27 nm, respectively. The crystallite size could be adjusted in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m).

Without substantial deterioration of electrical conductivity and Young's modulus, hardness, tensile strength, and 0.2% resisting force could be increased by 2 to 3 times. It was found that also elongation could be increased by 2 to 3 times. Softening point could be increased by 2.1 times. Roll-process could be carried out without heat treatment; and in addition, cross process could be carried out. It was further found that processability was enhanced. These characteristics could be balanced.

The various characteristics could be enhanced so that it became possible to balance these characteristics.

These effects could be realized in plates, wires, thin films, and powders.

Next, a method for manufacturing the metal alloy member having the afore-mentioned characteristics will be explained.

Firstly, in the case of the cast-molded alloy, the alloy material with the afore-mentioned composition is cast-molded, then, if necessary, the material is solution-treated in which rapid cooling is conducted after heating to a prescribed temperature, and further, if necessary, an ageing treatment is conducted thereafter at a prescribed temperature.

In the case of the processed metal alloy, the alloy material with the afore-mentioned composition is cast-molded, then, if necessary, the material is solution-treated in which rapid cooling is conducted after heating to a prescribed temperature, and then the material is processed to a prescribed form, wherein if necessary, the material is aged before or after this process.

In the titanium (Ti) alloy, the solution treatment may be done in the temperature

workability. Accordingly, this is different from conventional metal alloy members. Furthermore, an important feature thereof resides in that these characteristics can be adjusted in accordance with preference of a user.

Accordingly, the most significant feature of the present invention resides in that important functional characteristics of the high-function metal alloy of the foregoing elements can be enhanced so that a unique metal alloy having the characteristics thereof adjusted in accordance with preference of a user can be obtained.

According to the present invention, there are provided the following inventions:

(1) A fine crystallite high-function metal alloy member and a method for producing the same, wherein a metal alloy including a high-purity metal alloy whose crystal lattice is a face-centered cubic lattice, a body-centered cubic lattice, or a close-packed hexagonal lattice is made to contain therein 5 to 30000 ppm of gadolinium (Gd), and the crystallite thereof is made fine with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m).

(2) A fine crystallite high-function metal alloy member and a method for producing the same, wherein a metal alloy including a high-purity metal alloy whose crystal lattice is a face-centered cubic lattice is made to contain therein 5 to 30000 ppm of gadolinium (Gd), and the crystallite thereof is made fine with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m).

(3) A fine crystallite high-function metal alloy member and a method for producing the same, wherein a metal alloy including a high-purity metal alloy whose crystal lattice is a face-centered cubic lattice, a body-centered cubic lattice, or a close-packed hexagonal lattice is made to contain therein 5 to 30000 ppm of gadolinium (Gd) solely or gadolinium (Gd) together with at least one element selected from the group consisting of elements other than gadolinium (Gd), and the crystallite thereof is made fine with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m).

(4) A fine crystallite high-function metal alloy member and a method for producing the same, wherein a metal alloy including a high-purity metal alloy whose crystal lattice is a

face-centered cubic lattice is made to contain therein 5 to 30000 ppm of gadolinium (Gd) solely or gadolinium (Gd) together with at least one element selected from the group consisting of elements other than gadolinium (Gd), and the crystallite thereof is made fine with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m).

(5) A fine crystallite high-function metal alloy member and a method for producing the same, wherein a metal alloy including a high-purity metal alloy whose crystal lattice is a face-centered cubic lattice, a body-centered cubic lattice, or a close-packed hexagonal lattice is made to contain therein 5 to 30000 ppm of gadolinium (Gd) solely or gadolinium (Gd) together with at least one element selected from the group consisting of elements other than gadolinium (Gd), the crystallite thereof is made fine with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m), and the form thereof is adjusted, thereby remedying drawbacks thereof and enhancing various characteristics thereof without losing superior characteristics owned by the alloy itself.

(6) A fine crystallite high-function metal alloy member and a method for producing the same, wherein a metal alloy including a high-purity metal alloy whose crystal lattice is a face-centered cubic lattice is made to contain therein 5 to 30000 ppm of gadolinium (Gd) solely or gadolinium (Gd) together with at least one element selected from the group consisting of elements other than gadolinium (Gd), the crystallite thereof is made fine with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m), and the form thereof is adjusted, thereby remedying drawbacks thereof and enhancing various characteristics thereof without losing superior characteristics owned by the alloy itself.

(7) A business development method for developing, manufacturing, or selling a fine crystallite high-function metal alloy member, wherein a metal alloy including a high-purity metal alloy whose crystal lattice is a face-centered cubic lattice, a body-centered cubic lattice, or a close-packed hexagonal lattice is made to contain therein 5 to 30000 ppm of gadolinium (Gd), the crystallite thereof is made fine with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m), and the form thereof is adjusted, thereby remedying drawbacks thereof and enhancing various characteristics thereof without losing superior characteristics owned by the alloy itself.

(8) A business development method to for developing, manufacturing, or selling a fine crystallite high-function metal alloy member, wherein a metal alloy including a high-purity metal alloy whose crystal lattice is a face-centered cubic lattice is made to contain therein 5 to 30000 ppm of gadolinium (Gd), the crystallite thereof are made fine with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m), and the form thereof is adjusted, thereby remedying drawbacks thereof and enhancing various characteristics thereof without losing superior characteristics owned by the alloy itself.

(9) A fine crystallite high-function metal alloy member and a method for producing the same, wherein a crystallite of a metal alloy including a high-purity metal alloy whose crystal lattice is a face-centered cubic lattice, a body-centered cubic lattice, or a close-packed hexagonal lattice is made fine with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m), and the form thereof is adjusted, thereby remedying drawbacks thereof and enhancing various characteristics thereof without losing superior characteristics owned by the alloy itself.

(10) A fine crystallite high-function metal alloy member and a method for producing the same, wherein a crystallite of a metal alloy including a high-purity metal alloy whose crystal lattice is a face-centered cubic lattice is made fine with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m), and the form thereof is adjusted, thereby remedying drawbacks thereof and enhancing various characteristics thereof without losing superior characteristics owned by the alloy itself.

(11) A fine crystallite high-function metal alloy member and a method for producing the same, wherein a metal alloy including a high-purity metal alloy whose crystal lattice is a face-centered cubic lattice, a body-centered cubic lattice, or a close-packed hexagonal lattice is made to contain therein 5 to 30000 ppm of gadolinium (Gd) solely or gadolinium (Gd) together with at least one element selected from the group consisting of elements other than gadolinium (Gd), the crystallite thereof is made fine with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m), and the form thereof is adjusted, thereby enhancing tensile strength, elastic limit, heat resistance, corrosion resistance, processability, and elongation.

(12) A fine crystallite high-function metal alloy member and a method for producing the same, wherein a metal alloy including a high-purity metal alloy whose crystal lattice is a face-centered cubic lattice is made to contain therein 5 to 30000 ppm of gadolinium (Gd) solely or gadolinium (Gd) together with at least one element selected from the group consisting of elements other than gadolinium (Gd), the crystallite thereof is made fine with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m), and the form thereof is adjusted, thereby enhancing tensile strength, elastic limit, heat resistance, corrosion resistance, processability, and elongation without substantial deterioration of Young's modulus.

(13) The method for producing the fine crystallite high-function metal alloy member according to (1) to (12) described above, wherein the solution treatment is conducted by rapidly cooling the metal alloy after heating it in the temperature range of 200 to 2800°C, and the ageing treatment is conducted by heat-treating the crystalline metal alloy in the temperature range of 100 to 1600°C.

(14) The method for producing the fine crystallite high-function metal alloy member according to (1) to (13) described above, wherein after the solution treatment, processing treatment and ageing treatment are conducted alternately and repeatedly.

(15) A method for producing a fine crystallite high-function metal alloy member comprising the steps of:

cast-molding a material of the fine crystallite metal alloy member and the fine crystallite precious metal alloy member according (1) to (14) described above and

subjecting the said material to the solution treatment.

(16) A method for producing a fine crystallite high-function metal alloy member comprising the steps of:

cast-molding a material of the fine crystallite metal alloy member and the fine crystallite metal alloy member according to (1) to (15) described above,

subjecting the said material to the solution treatment, and

subjecting the material to the ageing treatment before and after the processing.

(17) A method for producing a fine crystallite high-function metal alloy member comprising the steps of:

cast-molding a material of the crystalline metal alloy member and the fine crystallite high-function metal alloy member according to (1) to (16) described above,

subjecting the said material to the solution treatment,

a processing the material to a prescribed form, and

subjecting the material to the ageing treatment before and after the processing.

(18) The method for producing the fine crystallite high-function metal alloy member according to any method of (1) to (17) described above, wherein temperature of the solution treatment is in the range of 300 to 2800°C and temperature of the ageing treatment is in the range of 100 to 1400°C.

(19) The method for producing the fine crystallite high-function metal alloy member according to any method of (1) to (17) described above, wherein temperature of the solution treatment is in the range of 300 to 2700°C and temperature of the ageing treatment is in the range of 50 to 1000°C.

(20) The method for producing the fine crystallite high-function metal alloy member according to any method of (1) to (17) described above, wherein temperature of the solution treatment is in the range of 250 to 2500°C and temperature of the ageing treatment is in the range of 100 to 800°C.

(21) Use of the high-function metal alloy according to the present invention, as a product with reduced size and weight.

(22) Use of the fine crystallite high-function metal alloy member according to the present invention, as a musical instrument material.

(23) Use of the fine crystallite high-function metal alloy member according to any one of the preceding claims, as an electronic material.

(24) Use of the fine crystallite high-function metal alloy member according to any one of the preceding claims, as a jewelry material.

(25) Use of the fine crystallite high-function metal alloy member according to any one of the preceding claims, as a structural material.

(26) Use of the fine crystallite high-function metal alloy member according to the present invention, as an automobile part.

(27) Use of the fine crystallite high-function metal alloy member according to the present invention, as an aerial part.

CLAIMS

1. A fine crystallite high-function metal alloy member and a method for producing the same, wherein a metal alloy including a high-purity metal alloy whose crystal lattice is a face-centered cubic lattice, a body-centered cubic lattice, or a close-packed hexagonal lattice is made to contain therein 5 to 30000 ppm of gadolinium (Gd), and the crystallite thereof is made fine with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m).

2. A fine crystallite high-function metal alloy member and a method for producing the same, wherein a metal alloy including a high-purity metal alloy whose crystal lattice is a face-centered cubic lattice is made to contain therein 5 to 30000 ppm of gadolinium (Gd), and the crystallite thereof is made fine with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m).

3. A fine crystallite high-function metal alloy member and a method for producing the same, wherein a metal alloy including a high-purity metal alloy whose crystal lattice is a face-centered cubic lattice, a body-centered cubic lattice, or a close-packed hexagonal lattice is made to contain therein 5 to 30000 ppm of gadolinium (Gd) solely or gadolinium (Gd) together with at least one element selected from the group consisting of elements other than gadolinium (Gd), and the crystallite thereof is made fine with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m).

4. A fine crystallite high-function metal alloy member and a method for producing the same, wherein a metal alloy including a high-purity metal alloy whose crystal lattice is a face-centered cubic lattice is made to contain therein 5 to 30000 ppm of gadolinium (Gd) solely or gadolinium (Gd) together with at least one element selected from the group consisting of elements other than gadolinium (Gd), and the crystallite thereof is made fine with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m).

5. A fine crystallite high-function metal alloy member and a method for producing the same, wherein a metal alloy including a high-purity metal alloy whose crystal lattice is a

face-centered cubic lattice, a body-centered cubic lattice, or a close-packed hexagonal lattice is made to contain therein 5 to 30000 ppm of gadolinium (Gd) solely or gadolinium (Gd) together with at least one element selected from the group consisting of elements other than gadolinium (Gd), the crystallite thereof is made fine with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m), and the form thereof is adjusted, thereby remedying drawbacks thereof and enhancing various characteristics thereof without losing superior characteristics owned by the alloy itself.

6. A fine crystallite high-function metal alloy member and a method for producing the same, wherein a metal alloy including a high-purity metal alloy whose crystal lattice is a face-centered cubic lattice is made to contain therein 5 to 30000 ppm of gadolinium (Gd) solely or gadolinium (Gd) together with at least one element selected from the group consisting of elements other than gadolinium (Gd), the crystallite thereof is made fine with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m), and the form thereof is adjusted, thereby remedying drawbacks thereof and enhancing various characteristics thereof without losing superior characteristics owned by the alloy itself.

7. A business development method for developing, manufacturing, or selling a fine crystallite high-function metal alloy member, wherein a metal alloy including a high-purity metal alloy whose crystal lattice is a face-centered cubic lattice, a body-centered cubic lattice, or a close-packed hexagonal lattice is made to contain therein 5 to 30000 ppm of gadolinium (Gd), the crystallite thereof is made fine with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m), and the form thereof is adjusted, thereby remedying drawbacks thereof and enhancing various characteristics thereof without losing superior characteristics owned by the alloy itself.

8. A business development method to for developing, manufacturing, or selling a fine crystallite high-function metal alloy member, wherein a metal alloy including a high-purity metal alloy whose crystal lattice is a face-centered cubic lattice is made to contain therein 5 to 30000 ppm of gadolinium (Gd), the crystallite thereof are made fine with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m), and the form thereof is adjusted, thereby remedying drawbacks thereof and enhancing

various characteristics thereof without losing superior characteristics owned by the alloy itself.

9. A fine crystallite high-function metal alloy member and a method for producing the same, wherein a crystallite of a metal alloy including a high-purity metal alloy whose crystal lattice is a face-centered cubic lattice, a body-centered cubic lattice, or a close-packed hexagonal lattice is made fine with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m), and the form thereof is adjusted, thereby remedying drawbacks thereof and enhancing various characteristics thereof without losing superior characteristics owned by the alloy itself.

10. A fine crystallite high-function metal alloy member and a method for producing the same, wherein a crystallite of a metal alloy including a high-purity metal alloy whose crystal lattice is a face-centered cubic lattice is made fine with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m), and the form thereof is adjusted, thereby remedying drawbacks thereof and enhancing various characteristics thereof without losing superior characteristics owned by the alloy itself.

11. A fine crystallite high-function metal alloy member and a method for producing the same, wherein a metal alloy including a high-purity metal alloy whose crystal lattice is a face-centered cubic lattice, a body-centered cubic lattice, or a close-packed hexagonal lattice is made to contain therein 5 to 30000 ppm of gadolinium (Gd) solely or gadolinium (Gd) together with at least one element selected from the group consisting of elements other than gadolinium (Gd), the crystallite thereof is made fine with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m), and the form thereof is adjusted, thereby enhancing tensile strength, elastic limit, heat resistance, corrosion resistance, processability, and elongation.

12. A fine crystallite high-function metal alloy member and a method for producing the same, wherein a metal alloy including a high-purity metal alloy whose crystal lattice is a face-centered cubic lattice is made to contain therein 5 to 30000 ppm of gadolinium (Gd) solely or gadolinium (Gd) together with at least one element selected from the group consisting of elements other than gadolinium (Gd), the crystallite thereof is made fine

with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m), and the form thereof is adjusted, thereby enhancing tensile strength, elastic limit, heat resistance, corrosion resistance, processability, and elongation without substantial deterioration of Young's modulus.

13. The method for producing the fine crystallite high-function metal alloy member according to the preceding claims, wherein the solution treatment is conducted by rapidly cooling the metal alloy after heating it in the temperature range of 200 to 2800°C, and the ageing treatment is conducted by heat-treating the crystalline metal alloy in the temperature range of 100 to 1600°C.

14. The method for producing the fine crystallite high-function metal alloy member according to the preceding claims, wherein after the solution treatment, processing treatment and ageing treatment are conducted alternately and repeatedly.

15. A method for producing a fine crystallite high-function metal alloy member comprising the steps of:

cast-molding a material of the fine crystallite metal alloy member and the fine crystallite precious metal alloy member according to the preceding claims and

subjecting the said material to the solution treatment.

16. A method for producing a fine crystallite high-function metal alloy member comprising the steps of:

cast-molding a material of the fine crystallite metal alloy member and the fine crystallite metal alloy member according to the preceding claims,

subjecting the said material to the solution treatment, and

subjecting the material to the ageing treatment before and after the processing.

17. A method for producing a fine crystallite high-function metal alloy member comprising the steps of:

cast-molding a material of the crystalline metal alloy member and the fine crystallite high-function metal alloy member according to the preceding claims,

subjecting the said material to the solution treatment,

a processing the material to a prescribed form, and

subjecting the material to the ageing treatment before and after the processing.

18. The method for producing the fine crystallite high-function metal alloy member according to any method of the preceding claims, wherein temperature of the solution treatment is in the range of 300 to 2800°C and temperature of the ageing treatment is in the range of 100 to 1400°C.

19. The method for producing the fine crystallite high-function metal alloy member according to any method of the preceding claims, wherein temperature of the solution treatment is in the range of 300 to 2700°C and temperature of the ageing treatment is in the range of 50 to 1000°C.

20. The method for producing the fine crystallite high-function metal alloy member according to any method of the preceding claims, wherein temperature of the solution treatment is in the range of 250 to 2500°C and temperature of the ageing treatment is in the range of 100 to 800°C.

21. Use of the high-function metal alloy according to any one of the preceding claims, as a product with reduced size and weight.

22. Use of the fine crystallite high-function metal alloy member according to any one of the preceding claims, as a musical instrument material.

23. Use of the fine crystallite high-function metal alloy member according to any one of the preceding claims, as an electronic material.

24. Use of the fine crystallite high-function metal alloy member according to any one of the preceding claims, as a jewelry material.

25. Use of the fine crystallite high-function metal alloy member according to any one of the preceding claims, as a structural material.

26. Use of the fine crystallite high-function metal alloy member according to any one of the preceding claims, as an automobile part.

27. Use of the fine crystallite high-function metal alloy member according to any one of the preceding claims, as an aerial part.

CLAIMS

1. A fine crystallite high-function metal alloy member, wherein a metal alloy including a high-purity metal alloy whose crystal lattice is a face-centered cubic lattice, a body-centered cubic lattice, or a close-packed hexagonal lattice is made to contain therein 5 to 30000 ppm of gadolinium (Gd), and the crystallite thereof is made fine with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m).

2. A method for producing a fine crystallite high-function metal alloy member, wherein the method comprises the steps of adding 5 to 30000 ppm of gadolinium (Gd) to a metal alloy including a high-purity metal alloy whose crystal lattice is a face-centered cubic lattice, a body-centered cubic lattice, or a close-packed hexagonal lattice, and cast-molding the obtained material to make the crystallite thereof fine with the size in the level of nanometers (10^{-9} m to 10^{-6} m) and micrometers (10^{-6} m to 10^{-3} m).

3. The method according to claim 2, wherein said metal alloy is a metal alloy including a high-purity metal alloy whose crystal lattice is a face-centered cubic lattice.

4. The method according to claim 2, wherein said metal alloy including a high-purity metal alloy is a metal alloy including a high-purity metal alloy of a metal selected from the group consisting of gold (Au), silver (Ag), platinum (Pt), palladium (Pd), aluminum (Al), magnesium (Mg), copper (Cu), iron (Fe) and titanium (Ti).

5. The method according to any one of claims 2 to 4, wherein said gadolinium (Gd) is gadolinium (Gd) solely or gadolinium (Gd) together with at least one element selected from the group consisting of elements other than gadolinium (Gd).

6. The method according to any one of claims 2 to 5, wherein the method comprises the steps of:

   cast-molding the material and

   subjecting the said material to the solution treatment.

7. The method according to any one of claims 2 to 5, wherein the method comprises the steps of:

cast-molding the material,

subjecting the said material to the solution treatment, and

subjecting the material to the ageing treatment.

8. The method according to any one of claims 2 to 5, wherein the method comprises the steps of:

cast-molding the material,

subjecting the said material to the solution treatment,

processing the material to a prescribed form, and

subjecting the material to the ageing treatment before and after the processing.

9. The method according to claim 8, wherein after the solution treatment, processing treatment and ageing treatment are conducted alternately and repeatedly.

10. The method according to any one of claims 6 to 9, wherein the solution treatment is conducted by rapidly cooling the metal alloy after heating it in the temperature range of 200 to 2800°C, and the ageing treatment is conducted by heat-treating the crystalline metal alloy in the temperature range of 100 to 1600°C.

11. The method according to any one of claims 6 to 9, wherein temperature of the solution treatment is in the range of 300 to 2800°C and temperature of the ageing treatment is in the range of 100 to 1400°C.

12. The method according to any one of claims 6 to 9, wherein temperature of the solution treatment is in the range of 300 to 2700°C and temperature of the ageing treatment is in the range of 50 to 1000°C.

13. The method according to any one of claims 6 to 9, wherein temperature of the solution treatment is in the range of 250 to 2500°C and temperature of the ageing treatment is in the range of 100 to 800°C.

14. The fine crystallite high-function metal alloy member according to claim 1, wherein the member is obtainable by the method according to any one of claims 2 to 13.

15. A product with reduced size and weight, a musical instrument material, an electronic material, a jewelry material, a structural material, an automobile part or an aerial part, used the fine crystallite high-function metal alloy member according to claim 14.