content (stoichiometry) of the film, and so the overall chemical stoichiometry of the sputtering target is critical. It would be desirable to be able to provide sputtering targets with a uniform chemical stoichiometry.

BRIEF DESCRIPTION

[0006] The present disclosure relates to aluminum alloys formed from aluminum and scandium, and articles formed therefrom having high uniformity. In some embodiments, the alloy contains from 12 atomic percent to 50 atomic percent (at%) of scandium. The alloys can be used to make articles such as sputtering targets that have high chemical uniformity, both across the surface of the sputtering target and through its thickness.

[0006a] In one aspect, there is provided a sputtering target formed from an alloy comprising scandium (Sc) and aluminum (Al), wherein the scandium is uniformly distributed across a surface of the sputtering target, as indicated by a difference of at most +/- 0.5 wt% scandium over an entire radius of the surface in both a horizontal direction and a vertical direction.

[0006b] In another aspect, there is provided a sputtering target formed from an alloy comprising from greater than 10 at% up to 50 at% scandium (Sc) and remainder aluminum (Al), wherein the scandium is uniformly distributed across a surface of the sputtering target, as indicated by a difference of at most +/- 0.5 wt% scandium over an entire radius of the surface in both a horizontal direction and a vertical direction.

[0006c] In another aspect, there is provided a sputtering target formed from an alloy comprising greater than 10 at% scandium (Sc) and remainder aluminum (Al), wherein the scandium is uniformly distributed across a surface of the sputtering target, as indicated by a difference of at most +/- 0.5 wt% scandium over an entire radius of the surface in both a horizontal direction and a vertical direction, and wherein the sputtering target contains less than 300 ppm of oxygen.

[0006d] In another aspect, there is provided a thin film formed by bombarding the sputtering target as described herein with ions to deposit material onto a substrate.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The following is a brief description of the drawings, which are presented for the purposes of illustrating the exemplary embodiments disclosed herein and not for the purposes of limiting the same.

[0008] **FIG. 1** is a cross-section of an Al-Sc sputtering target made via powder processing, and showing oxide inclusions.

[0009] **FIG. 2A** is a phase diagram for aluminum and scandium. The y-axis is temperature (°C) and runs from 0°C to 1600°C at intervals of 200°C. The y-axis also includes a notation at 660°C, the melting point of aluminum.

[0010] **FIG. 2B** is a magnified view of the phase diagram of **FIG. 2A** for 0 at% to 30 at% scandium.

[0011] **FIG. 3** is a photomicrograph of the microstructure, with Al_3Sc grains in an Al matrix.

[0012] **FIGS. 4A-4C** are photomicrographs showing the microstructure through the thickness of the casting. **FIG. 4A** is taken along the mold wall. **FIG. 4B** is further within the casting. **FIG. 4C** is taken at the center of the casting.

[0013] **FIG. 5** is a graph of wt% Sc vs. radius for a sputtering target made without control over cooling rate during the entire casting process. The y-axis is the wt% Sc, and increases along the y-axis. The x-axis is the radius in inches, and has a value of 0 at the center of the target.