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**ALUMINUM (AL) ANODE PLATE MATERIAL FOR AL-AIR BATTERY AND PREPARATION METHOD THEREOF, AL ANODE
PLATE FOR AL-AIR BATTERY AND PREPARATION METHOD AND USE THEREOF.**

(57)

The disclosure relates to the technical field of aluminum (Al)-air batteries, in particular to an Al anode plate material for an Al-air battery and a preparation method thereof, and an Al anode plate for an Al-air battery, a preparation method and use thereof. The disclosure provides an Al anode plate material for an Al-air battery, which includes the following elements by mass percentage: 0.02-0.2% of cerium (Ce), 0.02-0.2% of indium (In), 0.02-0.2% of tin (Sn), 0.3-0.7% of magnesium (Mg), and the balance being Al. The disclosure includes appropriate amounts of Ce, In, Sn and Mg in the Al anode plate material. The Ce in combination with the In, the Sn and the Mg shows a synergistic effect, so that alloy grains are refined, polarization is weakened, and electrochemical activity of an electrode plate is improved while relatively high corrosion resistance is ensured, which greatly improves discharge voltage and energy density of the Al anode plate. The disclosure is suitable for a high power alkaline Al-air battery with NaOH as an electrolyte.

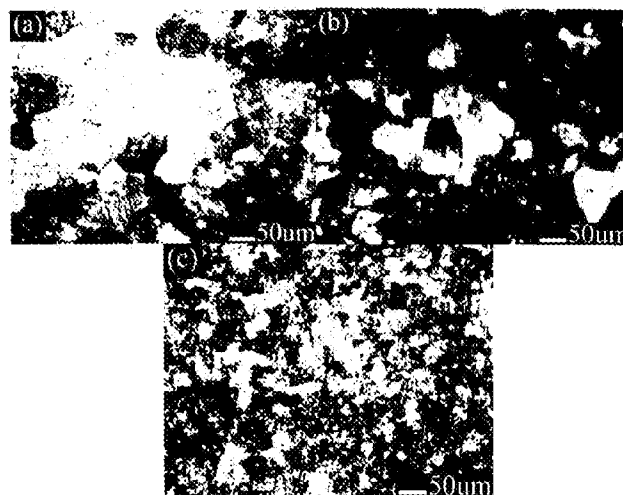


FIG. 1

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**ALUMINUM (AL) ANODE PLATE MATERIAL FOR AL-AIR BATTERY AND
PREPARATION METHOD THEREOF, AL ANODE PLATE FOR AL-AIR BATTERY
AND PREPARATION METHOD AND USE THEREOF**

TECHNICAL FIELD

The disclosure relates to the technical field of aluminum (Al)-air batteries, in particular to an Al anode plate material for an Al-air battery and a preparation method thereof, and an Al anode plate for an Al-air battery, a preparation method and use thereof.

BACKGROUND

Al-air batteries have advantages such as low cost, high specific volumetric capacity (8,200 Wh·kg⁻¹) and low toxicity, and thus have extremely high potential. An alkaline system uses a NaOH or KOH solution with extremely high conductivity as an electrolyte. An oxide film on a surface of an Al anode in the system can be dissolved by the electrolyte and activity of Al is high, so an output of a large current density and power can be achieved. Waste electrolyte produced after discharge of the Al-air battery can be used to recover aluminum oxide therein with an industrial Bayer method. Therefore, the alkaline system has higher application value. However, polarization of the Al anode of the Al-air battery of this system is serious during use, resulting in a discharge voltage and an energy density of the Al-air battery much lower than theoretical values, which hinders application of the Al-air battery.

SUMMARY

The disclosure aims to provide an Al anode plate material for an Al-air battery and a preparation method thereof, and an Al anode plate for an Al-air battery, a preparation method and use thereof. The disclosure can improve discharge voltage and energy density of the Al anode plate, and is suitable for a high power alkaline Al-air battery with NaOH as an electrolyte.

To achieve the above objective of the disclosure, the disclosure provides the following technical solutions:

The disclosure provides an Al anode plate material for an Al-air battery, which includes the following elements by mass percentage: 0.02-0.2% of cerium (Ce), 0.02-0.2% of indium (In), 0.02-0.2% of tin (Sn), 0.3-0.7% of magnesium (Mg), and the balance being Al.

Preferably, the Al has a content of above 99%.

The disclosure provides a method for preparing the Al anode plate material for an Al-air battery of the above solution, which includes the following steps:

melting pure Al to obtain molten Al;

adding Al-Ce alloy, metal In, metal Sn and metal Mg which are wrapped by Al foil to the molten Al to obtain a mixed melt;

casting the mixed melt to form an Al anode plate material for an Al-air battery;

where amounts of the pure Al, the Al-Ce alloy, the metal In, the metal Sn, the metal Mg and the Al foil correspond to element composition of the Al anode plate material for the Al-air battery in the above solution.

Preferably, a mass percentage of the Ce in the Al-Ce alloy is 5-20%.

The disclosure provides an Al anode plate for an Al-air battery, which is prepared from the Al anode plate material for an Al-air battery of the above solution or an Al anode plate material for an Al-air battery prepared by the method of the above solution.

The disclosure provides a method for preparing an Al anode plate for an Al-air battery, which includes the following steps:

rolling and annealing an Al anode plate material for an Al-air battery in sequence to obtain an Al anode plate for an Al-air battery;

where the Al anode plate material for an Al-air battery is the one of the above solution or prepared by the method of the above solution.

Preferably, the annealing is carried out at 300-400°C for 3-15 h.

Preferably, the rolling is cold rolling.

The disclosure provides use of the Al anode plate for an Al-air battery of the above solution or an Al anode plate for an Al-air battery prepared by the method of the above solution as an anode in an Al-air battery.

The disclosure provides an Al anode plate material for an Al-air battery, which includes the following elements by mass percentage: 0.02-0.2% of Ce, 0.02-0.2% of In, 0.02-0.2% of Sn, 0.3-0.7% of Mg, and the balance being Al. The disclosure includes appropriate amounts of Ce, In, Sn and Mg in the Al anode plate material. The Ce in combination with the In, the Sn and the Mg shows a synergistic effect, so that alloy grains are refined, polarization is weakened, and electrochemical activity of an electrode plate is improved while relatively high corrosion resistance is ensured, which greatly improves discharge voltage and energy density of the Al anode plate. At the same time, the Ce can protect the In, the Sn and the Mg from oxidation during an Al anode plate production process, promote an overall reaction of the battery, and improve electrochemical performance of an electrode.

Results of examples show that, compared with the pure Al plate, the anode plate for an Al-air battery prepared by the Al anode plate material for an Al-air battery of the disclosure has a discharge voltage increased by 0.048-0.194 V and an energy density increased by 2-6.5 times at a low current density of 40 mA·cm⁻². The disclosure can achieve discharge at a high current density of 100 mA·cm⁻², where a discharge voltage can reach 1 V, and an energy density can reach 3000 Wh·kg⁻¹.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 shows metallographic phase images of the Al anode plates for an Al-air battery prepared in Comparative Example, Example 2 and Example 10.

DETAILED DESCRIPTION

The disclosure provides an Al anode plate material for an Al-air battery, which includes the following elements by mass percentage: 0.02-0.2% of Ce, 0.02-0.2% of In, 0.02-0.2% of Sn, 0.3-0.7% of Mg, and the balance being Al.

Based on mass percentage, the Al anode plate material for an Al-air battery provided by the disclosure includes the Ce in an amount of 0.02-0.2%, preferably 0.06-0.10%, more preferably 0.08%. In examples of the disclosure, a content of the Ce is specifically 0.02%, 0.04%, 0.06%, 0.08%, 0.10%, 0.14% or 0.18%. In the disclosure, the Ce can ensure that grains of the Al anode plate material for an Al-air battery are refined, polarization is weakened, and self-corrosion rate is reduced. At the same time, the Ce can protect the In, the Sn and the Mg from oxidation during an Al anode plate production process, promote an overall reaction of the battery, and improve electrochemical performance of an electrode.

Based on mass percentage, the Al anode plate material for an Al-air battery provided by the disclosure includes the In in an amount of 0.02-0.2%, preferably 0.025-0.125%, more preferably 0.05%. In examples of the disclosure, a content of the In is specifically 0.025%, 0.05%, 0.075%, 0.100% or 0.125%.

Based on mass percentage, the Al anode plate material for an Al-air battery provided by the disclosure includes the Sn in an amount of 0.02-0.2%, preferably 0.04-0.15%, more preferably 0.06-0.08%. In examples of the disclosure, a content of the Sn is specifically 0.02%, 0.04%, 0.06% or 0.08%.

Based on mass percentage, the Al anode plate material for an Al-air battery provided by the disclosure includes the Mg in an amount of 0.3-0.7%, preferably 0.4-0.6%. In examples of the disclosure, a content of the Mg is specifically 0.3%, 0.4%, 0.5%, 0.6% or 0.7%. In the disclosure, the Mg can change a microstructure of an Al anode, reduce adverse effects of impurity elements, and reduce hydrogen evolution corrosion.

In the disclosure, the Ce in combination with the In, the Sn and the Mg shows a synergistic effect, so that alloy grains are refined, polarization is weakened, and electrochemical activity of an electrode plate is improved while a relatively high corrosion resistance is ensured, which greatly improves discharge voltage and energy density of the Al anode plate.

Based on mass percentage, the Al anode plate material for an Al-air battery provided by the disclosure includes the Al as balance, preferably in an amount of 99% or more.

The Al anode plate material for an Al-air battery provided by the disclosure also includes inevitable impurities.

The disclosure provides a method for preparing the Al anode plate material for an Al-air battery of the above technical solution, which includes the following steps:

melting pure Al to obtain molten Al;

adding Al-Ce metal alloy, metal In, metal Sn and metal Mg which are wrapped by Al foil to the molten Al to obtain a mixed melt;

casting the mixed melt to form an Al anode plate material for an Al-air battery;

where amounts of the pure Al, the Al-Ce alloy, the metal In, the metal Sn, the metal Mg and the Al foil correspond to element composition of the Al anode plate material for an Al-air battery.

In the disclosure, raw materials used are all commercially available products well known in the art, unless otherwise specified.

The disclosure includes melting pure Al to obtain molten Al. In the disclosure, the pure Al preferably has a purity of 99.9% or more. The disclosure has no special requirement on a process of the melting, and a process of melting well known in the art can be used.

After the molten Al is obtained, the disclosure includes adding Al-Ce alloy, metal In, metal Sn, metal Mg and Al foil to the molten Al to obtain a mixed melt.

In the disclosure, a mass percentage of the Ce in the Al-Ce alloy is preferably 5-20%, more preferably 8-17%, and still more preferably 10-15%. A rare earth element (Ce) is used in the form of an Al-based master alloy, which greatly reduces cost of purchasing the rare earth metal while maintaining excellent properties of the rare earth element (Ce). At the same time, since a melting point of an Al-based Al-Ce alloy is much lower than that of the rare earth metal, difficulty of manufacturing the Al anode plate material is reduced. Moreover, compared with use of a pure rare earth metal, the Al-based Al-Ce alloy also has an advantage of high utilization rate of alloying elements.

In the disclosure, the metal In, the metal Sn and the metal Mg are preferably used in the form of metal particles. The disclosure has no special requirement on particle sizes of the metal particles, and particle sizes well known to those skilled in the art can be used. In the disclosure, the metal In, the metal Sn and the metal Mg preferably have a purity of more than 99.9%. In the disclosure, the In and the Sn are enriched in alloy grain boundaries in the form of segregated phases, and activate the Al anode plate in the form of "dissolution-redeposition" and "low solid solution".

In the disclosure, the Al-Ce alloy, the metal In, the metal Sn and the metal Mg are preferably wrapped by the Al foil. The disclosure has no special requirement on a thickness of the Al foil, and a thickness sufficient to completely wrap the Al-Ce alloy, the metal In, the metal Sn and the

metal Mg can be used. In the disclosure, the Al foil is used to wrap the Al-Ce alloy, the metal In, the metal Sn and the metal Mg to reduce oxidation of the In, the Sn and the Mg. At the same time, the Ce can also inhibit the oxidation of the In, the Sn and the Mg.

In the disclosure, amounts of the pure Al, the Al-Ce alloy, the metal In, the metal Sn, the metal Mg and the Al foil correspond to element composition of the Al anode plate material for an Al-air battery.

In the disclosure, during the melting pure Al and the adding Al-Ce metal alloy, metal In, metal Sn and metal Mg which are wrapped by Al foil for melting, refining and slag removal and the like can be carried out according to actual needs.

After the mixed melt is obtained, the disclosure includes casting the mixed melt to form an Al anode plate material for an Al-air battery. In the disclosure, the casting is preferably carried out in a mold. The disclosure has no special requirements on a casting forming process, and a casting forming process well known in the art can be used. After casting forming, the obtained Al anode plate material for an Al-air battery is preferably a plate material. The disclosure has no special requirements on thickness of the plate material. Those skilled in the art can choose the thickness according to actual needs. In examples of the disclosure, the thickness is specifically 1 cm.

The disclosure provides an Al anode plate for an Al-air battery, which is prepared from the Al anode plate material for an Al-air battery of the above solution or an Al anode plate material for an Al-air battery prepared by the method of the above solution.

The disclosure provides a method for preparing an Al anode plate for an Al-air battery, which includes the following steps:

rolling and annealing an Al anode plate material for an Al-air battery in sequence to obtain an Al anode plate for an Al-air battery;

where the Al anode plate material for an Al-air battery is the one of the above solution or prepared by the method of the above solution.

The disclosure includes rolling an Al anode plate material for an Al-air battery to obtain a rolled plate. In the disclosure, the rolling is preferably cold rolling. The rolling is preferably multi-pass rolling. The disclosure has no special requirements on reduction of each rolling pass, as long as cracking of the rolled plate can be prevented. In examples of the disclosure, a thickness of the Al anode plate material for an Al-air battery is 1 cm, total reduction of the rolling is 80%, reduction of each pass is 20%, and a thickness of an obtained rolled plate is 0.2 cm. In the disclosure, the rolling is carried out, so that the Al anode plate can obtain a thickness for actual use. At the same time, the grains of the Al anode plate material are secondarily refined by the rolling and the annealing.

After the rolled plate is obtained, the disclosure includes annealing the rolled plate to obtain an Al anode plate for an Al-air battery. In the disclosure, the annealing is carried out at preferably 300-400°C, more preferably 320-380°C, most preferably 350°C for preferably 3-15 h, more preferably 5-10 h, and most preferably 6 h. The disclosure uses annealing to grow a fiber structure of the rolled Al anode plate into subgrains with more uniform chemical composition in crystals, thereby improving electrochemical performance of the Al anode plate. U102451

The disclosure provides use of the Al anode plate for an Al-air battery of the above solution or an Al anode plate for an Al-air battery prepared by the method of the above solution as an anode in an Al-air battery. The Al anode plate for an Al-air battery of the disclosure is suitable for a high power alkaline Al-air battery with NaOH as an electrolyte.

The Al anode plate material of an Al-air battery and a preparation method thereof, and the Al anode plate for an Al-air battery, a preparation method and use thereof provided by the disclosure will be described in detail in connection with the following examples, but the examples should not be construed as limiting the claimed scope of the disclosure.

Example 1

Step 1: high pure Al was melt to obtain molten Al.

Step 2: Al-based Al-Ce alloy and metals In, Sn and Mg which were wrapped by Al foil were added to the molten Al obtained in step 1 (a total mass of each sample was 200 g, and addition by mass percentage was shown in Table 1), thoroughly mixing the five components to obtain a mixed melt.

Step 3: the mixed melt obtained in step 2 was casted in a mold to form a plate-shaped material for preparation of an Al electrode plate for an Al-air battery. A casted plate had a thickness of 1 cm.

Step 4: a plate material prepared in step 3 was rolled by a rolling mill (a rolled anode had a thickness of 0.2 cm, and a reduced thickness of each pass was 0.2 cm), and then annealed (heat treatment process was shown in Table 1) to obtain an Al anode plate for an Al-air battery.

Examples 2-11 and Comparative Example

Specific compositions and annealing processes were shown in Table 1, and the rest were the same as in Example 1.

Table 1 Compositions and annealing parameters of anode plates for an Al-air battery in Examples 1-11 and Comparative Example LU102451

No.	In/wt%	Sn/wt%	Mg/wt%	Ce/wt%	Al/wt%	Annealing
Comparative Example	0	0	0	0	99.9	300°C-6h
Example 1	0.025	0.02	0.6	0.06	As balance	300°C-6h
Example 2	0.050	0.04	0.3	0.10	As balance	300°C-6h
Example 3	0.075	0.04	0.5	0.18	As balance	300°C-6h
Example 4	0.050	0.08	0.4	0.02	As balance	300°C-6h
Example 5	0.125	0.06	0.7	0.04	As balance	300°C-6h
Example 6	0.075	0.04	0.5	0.06	As balance	300°C-6h
Example 7	0.075	0.04	0.5	0.14	As balance	300°C-6h
Example 8	0.050	0.06	0.5	0.08	As balance	300°C-6h
Example 9	0.050	0.06	0.5	0.08	As balance	350°C-3h
Example 10	0.050	0.06	0.5	0.08	As balance	350°C-6h
Example 11	0.050	0.06	0.5	0.08	As balance	400°C-3h

Structural characterization and performance test

1. Metallographic structures of the Al anode plates prepared in Comparative Example, Example 2 and Example 10 were observed and results were shown in FIG. 1 (specifically, in FIG. 1, (a) corresponded to Comparative Example, (b) corresponded to Example 2, and (c) corresponded to Example 10). It can be seen from FIG. 1 that, the Al anode plate prepared by the disclosure had finer grains compared with the pure Al plate and had a uniform size. Moreover, it can be seen from (b) and (c) in FIG. 1 that, effects were most significant when the annealing was carried out at 350°C-6h.

2. The Al anode plates prepared in the above Examples and Comparative Example were applied to Al-air batteries. A 4 mol/L NaOH aqueous solution was added as an electrolyte. Performance of each Al anode plate was measured with results in Table 2.

Table 2 Performance of the Al-air batteries associated with Examples and Comparative Example

No.	Open circuit potential	40 mA·cm ⁻²		100 mA·cm ⁻²		Self-corrosion rate (mg·cm ⁻² ·h ⁻¹)
		Discharge voltage (V)	Energy density (Wh·kg ⁻¹)	Discharge voltage (V)	Energy density (Wh·kg ⁻¹)	
Comparative Example	1.59	1.17	771.28	0.006	103.02	4.268
Example 1	1.60	1.364	1837.04	0.990	3000.00	10.12
Example 2	1.62	1.351	2953.01	1.022	2945.24	8.90
Example 3	1.63	1.357	2329.61	1.113	3117.65	11.89
Example 4	1.74	1.335	2567.31	1.066	3269.94	15.66
Example 5	1.67	1.349	3270.30	1.039	2886.11	11.09
Example 6	1.48	1.218	2298.11	0.856	2734.82	14.64
Example 7	1.47	1.292	2118.03	1.108	2682.81	14.21
Example 8	1.47	1.259	2289.09	0.812	2224.66	14.03
Example 9	1.51	1.277	2935.53	0.982	3116.65	12.332
Example 10	1.50	1.270	4837.64	0.985	3283.62	10.264
Example 11	1.48	1.267	1656.55	1.085	3021.65	11.284

It can be seen from results in Table 2 that, the pure Al had an open circuit potential of 1.59 V; a discharge voltage of 1.17 V and an energy density of 771.28 Wh·kg⁻¹ at a low current density of 40 mA·cm⁻²; a discharge voltage too low for discharge at a high current density of 100 mA·cm⁻²; and a self-corrosion rate of 4.268 mg·cm⁻²·h⁻¹. Compared with the pure Al plate, the Al anode plate prepared by the disclosure had a wider selection range of the open circuit potential between 1.47-1.74 V; a discharge voltage increased by about 0.048-0.194 V and an energy density

increased by 2-6.5 times at a low current density of $40 \text{ mA} \cdot \text{cm}^{-2}$. The disclosure can achieve discharge at a high current density of $100 \text{ mA} \cdot \text{cm}^{-2}$, where the discharge voltage can reach 1 V, and the energy density can reach $3000 \text{ Wh} \cdot \text{kg}^{-1}$. The disclosure had an increased self-corrosion rate, but the anode performance was still far better than that of the pure Al.

At the same time, comparison of Example 8-11 proved that the annealing process for the anode of the disclosure can increase the energy density of the anode, and effects were most significant at 350°C -6h.

The above descriptions are merely preferred implementations of the disclosure. It should be noted that a person of ordinary skill in the art may further make several improvements and modifications without departing from the principle of the disclosure, but such improvements and modifications should be deemed as falling within the protection scope of the disclosure.

What is claimed is:

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1. An aluminum (Al) anode plate material for an Al-air battery, comprising the following elements by mass percentage: 0.02-0.2% of cerium (Ce), 0.02-0.2% of indium (In), 0.02-0.2% of tin (Sn), 0.3-0.7% of magnesium (Mg), and the balance being Al.
2. The Al anode plate material for an Al-air battery according to claim 1, wherein the Al has a content of above 99%.
3. A method for preparing the Al anode plate material for an Al-air battery according to claim 1 or claim 2, comprising the following steps:
 - melting pure Al to obtain molten Al;
 - adding Al-Ce alloy, metal In, metal Sn and metal Mg which are wrapped by Al foil to the molten Al to obtain a mixed melt;
 - casting the mixed melt to form an Al anode plate material for an Al-air battery;
 - wherein amounts of the pure Al, the Al-Ce alloy, the metal In, the metal Sn, the metal Mg and the Al foil correspond to element composition of the Al anode plate material for an Al-air battery according to claim 1 or claim 2.
4. The method according to claim 3, wherein, a mass percentage of the Ce in the Al-Ce alloy is 5-20%.
5. An Al anode plate for an Al-air battery, wherein the Al anode plate for an Al-air battery is prepared from the Al anode plate material for an Al-air battery according to claim 1 or claim 2 or an Al anode plate material for an Al-air battery prepared by the method according to claim 3 or claim 4.
6. A method for preparing an Al anode plate for an Al-air battery, comprising the following steps:
 - rolling and annealing an Al anode plate material for an Al-air battery in sequence to obtain an Al anode plate for an Al-air battery;
 - wherein the Al anode plate material for an Al-air battery is the Al anode plate material for an Al-air battery according to claim 1 or claim 2 or prepared by the method according to claim 3 or claim 4.
7. The method according to claim 6, wherein the annealing is carried out at 300-400°C for 3-15 h.
8. The method according to claim 6, wherein the annealing is cold annealing.
9. Use of the Al anode plate for an Al-air battery according to claim 5 or an Al anode plate for an Al-air battery prepared by the method according to any of claims 6-8 as an anode in an Al-air battery.

Ansprüche

1. Aluminium (Al) -Anodenplattenmaterial für eine Al-Luft-Batterie, umfassend die folgenden Elemente in Massenprozent: 0,02–0,2% Cer (Ce), 0,02–0,2% Indium (In), 0,02–0,2% Zinn (Sn), 0,3-0,7% Magnesium (Mg), wobei der Rest Al ist.
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2. Al-Anodenplattenmaterial für eine Al-Luft-Batterie nach Anspruch 1, wobei das Al einen Gehalt von über 99% aufweist.
- 10 3. Verfahren zur Herstellung des Al-Anodenplattenmaterials für eine Al-Luft-Batterie nach Anspruch 1 oder Anspruch 2, umfassend die folgenden Schritte:
Schmelzen von reinem Al, um geschmolzenes Al zu erhalten;
Zugabe von Al-Ce-Legierung, Metall In, Metall Sn und Metall Mg, die mit Al-Folie umwickelt sind, zu dem geschmolzenen Al, um eine gemischte Schmelze zu erhalten;
15 Gießen der gemischten Schmelze, um ein Al-Anodenplattenmaterial für eine Al-Luft-Batterie zu bilden;
wobei die Mengen des reinen Al, der Al-Ce-Legierung, des Metalls In, des Metalls Sn, des Metalls Mg und der Al-Folie der Elementzusammensetzung des Al-Anodenplattenmaterials für eine Al-Luft-Batterie gemäß Anspruch 1 oder Anspruch 2 entsprechen.
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4. Verfahren nach Anspruch 3, wobei ein Massenprozentsatz des Ce in der Al-Ce-Legierung 5 bis 20% beträgt.
- 25 5. Al-Anodenplatte für eine Al-Luftbatterie, wobei die Al-Anodenplatte für eine Al-Luftbatterie hergestellt ist aus dem Al-Anodenplattenmaterial für eine Al-Luftbatterie nach Anspruch 1 oder Anspruch 2, oder aus einem Al-Anodenplattenmaterial für eine Al-Luft-Batterie, hergestellt nach dem Verfahren nach Anspruch 3 oder Anspruch 4.
- 30 6. Verfahren zur Herstellung einer Al-Anodenplatte für eine Al-Luft-Batterie, umfassend die folgenden Schritte:
nacheinander Walzen und Glühen eines Al-Anodenplattenmaterials für eine Al-Luft-Batterie, um eine Al-Anodenplatte für eine Al-Luft-Batterie zu erhalten;
wobei das Al-Anodenplattenmaterial für eine Al-Luftbatterie das Al-Anodenplattenmaterial für eine Al-Luftbatterie nach Anspruch 1 oder Anspruch 2 ist, oder durch das Verfahren nach

Anspruch 3 oder Anspruch 4 hergestellt ist.

7. Verfahren nach Anspruch 6, wobei das Glühen während 3-15 Stunden bei 300-400°C durchgeführt wird.

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8. Verfahren nach Anspruch 6, wobei das Glühen ein Kaltglühen ist.

9. Verwendung der Al-Anodenplatte für eine Al-Luft-Batterie nach Anspruch 5 oder einer Al-Anodenplatte für eine Al-Luft-Batterie gemäß dem Verfahren nach einem der Ansprüche 6 bis 8 als Anode in einer Al-Luft-Batterie .

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DRAWINGS

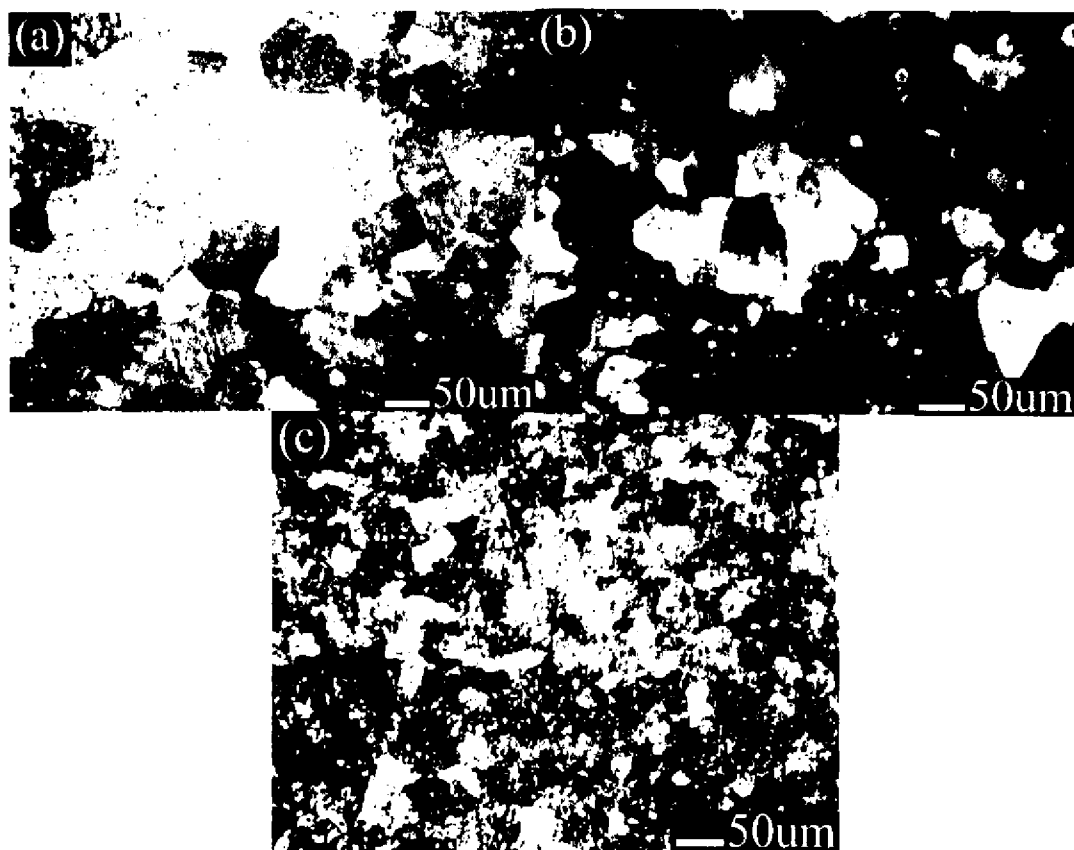


FIG. 1