PTL2: JP 6898627 B

PTL3: JP 7130197 B

Non Patent Literature

[0006]

NPL1: Journal of the Society of Inorganic Materials, 2014, Vol.21, p.197-203

NPL2: Atmospheric Pollution Research, 2020, Vol.11, Issue 2, p.290-295

Summary

Technical Problem

[0007] Conventional Mg-Al LDHs used for treatment of acid exhaust gases do not always have high adsorption capability of acidic substances such as nitrogen oxide and sulfur oxide, and reach saturation fast, and require regeneration treatment at a high frequency and thus heavy burden of effort and cost for the regeneration treatment process.

Hence, in order to enhance the adsorption capability of the acidic substances in acid exhaust gases and reduce the frequency of the regeneration treatment, a Mg-Al LDH that has long breakthrough time is demanded.

[0008] The present disclosure has been achieved in order to solve such a problem, and has an object to provide an acid gas treatment agent and a method for treating acid gas which use a Mg-Al LDH that has high adsorption capability to acidic substances and long breakthrough time in order to reduce the frequency of the regeneration treatment of the treatment agent.

Solution to Problem

[0009] The present disclosure is based on the finding that due to that the mean pore size and the sulfate ion content of a Mg-Al LDH are in predetermined ranges, an acid gas treatment agent that has high adsorption capability to acidic substances and long breakthrough time can be obtained.

[0010] The present disclosure provides the following means.

[1] An acid gas treatment agent, comprising a Mg-Al layered double hydroxide having a mean pore size of 30 nm or larger as measured by a nitrogen gas adsorption method and a sulfate ion content of 1% by mass or lower.

[2] The acid gas treatment agent according to [1], wherein the Mg-Al layered double hydroxide is of carbonate type or hydroxide type.

[3] The acid gas treatment agent according to [1] or [2], wherein an element molar ratio of Mg to Al of the Mg-Al layered double hydroxide is 2 to 3.

[4] The acid gas treatment agent according to any one of [1] to [3], wherein the Mg-Al layered double hydroxide has a cumulative volume 50% particle diameter D50 of 13.0 to 16.0 μm and a ratio (D90/D10) of a cumulative volume 90% particle diameter D90 to a cumulative volume 10% particle diameter D10 of 55 to 75.

[5] A molded article, comprising the acid gas treatment agent according to any one of [1] to [4].

[6] A method for treating acid gas, comprising contacting the acid gas treatment agent according to any one of [1] to [4] or the molded article according to [5] with an acid gas comprising an acidic substance to reject the acidic substance.

[0010a] In an aspect, the present disclosure provides an acid gas treatment agent, comprising a Mg-Al layered double hydroxide of carbonate type having a mean pore size of 30 nm or larger as measured by a nitrogen gas adsorption method and a sulfate ion content of 1% by mass or lower.

[0010b] In another aspect, the present disclosure provides a molded article, comprising the acid gas treatment agent as disclosed herein.

[0010c] In another aspect, the present disclosure provides a method for treating acid gas, comprising contacting the acid gas treatment agent as disclosed herein or the molded article as disclosed herein with an acid gas comprising an acidic substance to reject the acidic substance.

Advantageous Effects

[0011] According to the present disclosure, there are provided an acid gas treatment agent and a method for treating acid gas which use a Mg-Al LDH that has high adsorption capability to acidic substances and long breakthrough time. Thus, according to the present disclosure, the frequency of regeneration treatment of the acid gas treatment agent can be reduced, and the rejection efficiency of the acidic substances in the acid gas can be enhanced.

Brief Description of Drawing

[0012] [Fig. 1] Fig. 1 is a graph showing breakthrough curves in an acid gas adsorption test in Examples.

Description of Embodiments

[0013] In the present description, a numerical range indicated by using "to" means that whose lower limit value and upper limit value are numerical values before and after the "to",

respectively. A preferable numerical range can be set by optionally combining a preferable lower limit value and upper limit value.

[0014] The acid gas treatment agent of the present invention comprises a Mg-Al LDH having a mean pore size of 30 nm or larger as measured by a nitrogen gas adsorption method and a sulfate ion content of 1% by mass or lower.

[0015] Mg-Al LDHs are nanoparticles having a structure in which hydroxide basic layers ($[Mg^{2+}_{1-x}Al^{3+}_{x}(OH)_2]$) and intermediate layers ($[(Al^{n-})_{x/n}\cdot yH_2O]$) constituted of interlayer anions (An^{n-}) and interlayer water are stacked alternately. Mg-Al LDHs are non-stoichiometric compounds in which the hydroxide basic layer has positive charges corresponding to x, and anions having negative charges compensating the positive charges present between layers thereof.

CLAIMS

[Claim 1]

An acid gas treatment agent, comprising a Mg-Al layered double hydroxide of carbonate type having a mean pore size of 30 nm or larger as measured by a nitrogen gas adsorption method and a sulfate ion content of 1% by mass or lower.

[Claim 2]

The acid gas treatment agent according to claim 1, wherein an element molar ratio of Mg to Al of the Mg-Al layered double hydroxide is 2 to 3.

[Claim 3]

The acid gas treatment agent according to claim 1, wherein the Mg-Al layered double hydroxide has a cumulative volume 50% particle diameter D50 of 13.0 to 16.0 μm and a ratio (D90/D10) of a cumulative volume 90% particle diameter D90 to a cumulative volume 10% particle diameter D10 of 55 to 75.

[Claim 4]

A molded article, comprising the acid gas treatment agent according to claim 1.

[Claim 5]

A method for treating acid gas, comprising contacting the acid gas treatment agent according to claim 1 or the molded article according to claim 4 with an acid gas comprising an acidic substance to reject the acidic substance.