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Day 1 16:30-18:00 Foyer (Building An, 2nd floor)
Poster session No.29

Effects of trace amounts of additives on the aging of the slurry properties

微量添加物がスラリー特性経時変化に及ぼす影響

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1. Introduction

In wet process

The quality of the product depends on the particle dispersion state of slurries.

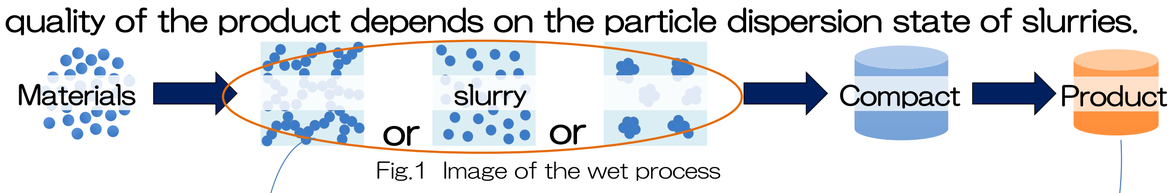


Fig.1 Image of the wet process

ex. Battery material, Paint, Ceramics...

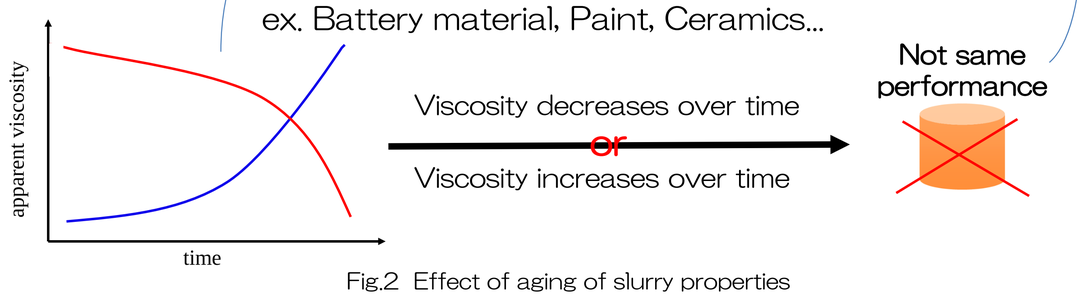


Fig.2 Effect of aging of slurry properties

In previous studies, it has been reported that the slurry properties change over time. However the mechanism of time change of slurry properties has not been clarified yet.

Purpose

In this study, the purpose is to clarify what type of slurry changes its property over time as the first step to predict/suppress slurry characteristics change over time.

2. Experiment

materials

Particles

Two types of Alumina -Al_2O_3-
(AES11E, Sumitomo Chemical Co., LTD. d_{50} = 0.48 μm,
/ AES12, Sumitomo Chemical Co., LTD d_{50} = 0.48 μm)

Table1 The composition of the powder

mass%	Al_2O_3	SiO_2	MgO	Fe_2O_3	Na_2O	L.O.I	H_2O
AES12	99.9	0.06	–	0.01	0.04	0.01	0.01
AES11E	99.8	0.06	0.1	0.01	0.04	0.01	0.02

Media
Deionized water

Additive
Magnesium chloride -$MgCl_2$-
(Wako Pure Chemical Industries, Ltd.)

Polymer
PCA -Polycarboxylic acid ammonium-
(Celuna D-305, CHUKYO YUSHI CO., LTD.)

Slurry preparation and evalution

Slurry preparation

Materials weighing and mixing
Ball milling (55 rpm, 1 hour)
Vacuum deforming (10 min)
Stirring (300 rpm, 5 days)

AES11E
Particle conc. : 20 vol%
PCA additive dosage : 0, 1.6, 2.0 mg/g Al_2O_3

AES12
Particle conc. : 20 vol%
PCA additive dosage :1.6, 2.0 mg/g Al_2O_3
Additive conc : 0, 10 mM
(Two kinds of solvents, Deionized water and aqueous solution containing Mg ions were used.)

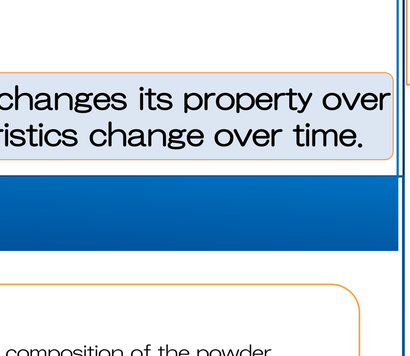


Fig.3 Zeta potential of particle

Physical property evaluation

Flow properties evaluation

Device : Coaxial cylinder viscometer (Anton Paar、Rheolab QC)
Shear rate : 0 ～ 1000 s^{-1} Preset temperature : 25℃

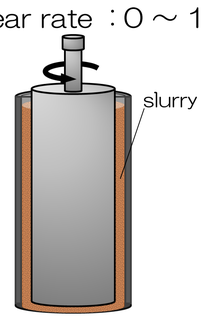


Fig.4 Illustration of viscometer

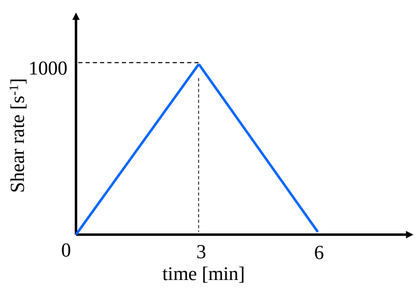


Fig.5 Measurement condition

Sedimentation test

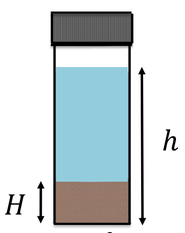


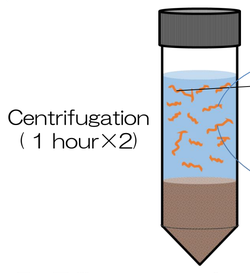
Fig.6 Illustration of centrifuged slurry

Packing fraction Φ [-]

$$\Phi = \frac{h}{H}\phi$$

Particle conc. Φ [-]

Polymer adsorbed amount, Measurement of Ion elution



TOC
(SHIMAZU SCIENCE Co., LTD, TOC-V)
Combustion temperature : 680 ℃

ICP-OES
(Hitachi High-Tech Science Co., LTD, SPS7800)
Measuring element: Magnesium

Fig.7 Illustration of centrifuged slurry

3. Results and discussion

Flow properties evaluation

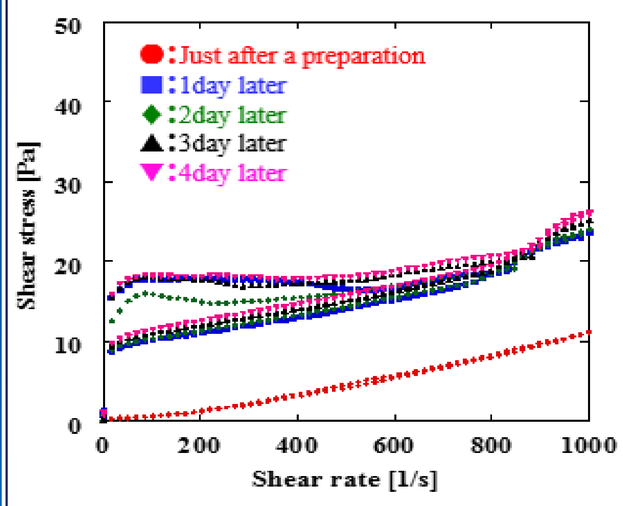


Fig.8 Flow curves of AES11E (PCA 2.0 mg/g Al_2O_3) slurry

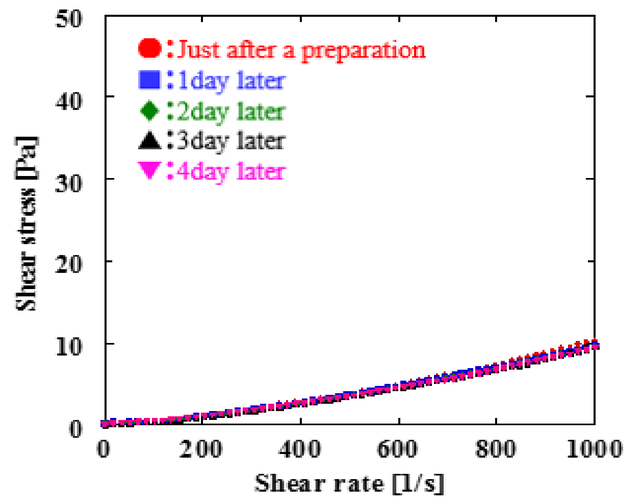


Fig.9 Flow curves of AES12 (PCA 2.0 mg/g Al_2O_3) slurry

- The apparent viscosity of AES11E slurry, in which elution of Mg^{2+} was confirmed, increased after one day passed after preparation.
- No increase in apparent viscosity like AES11E was observed in AES12 slurry without elution of Mg^{2+}.

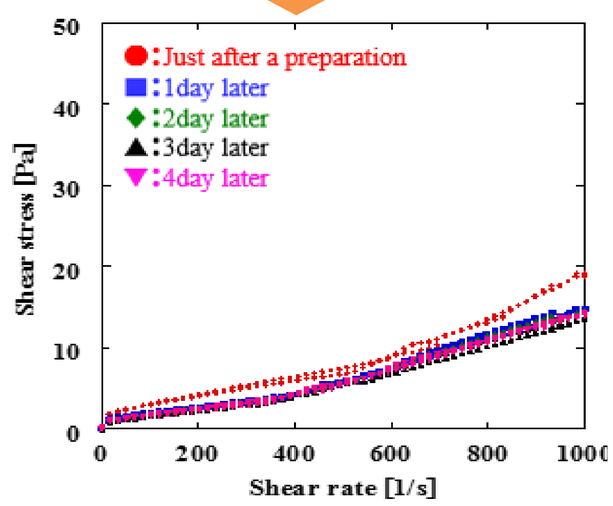


Fig.10 Flow curves of AES12 (PCA 2.0 mg/g Al_2O_3) + Mg^{2+} slurry

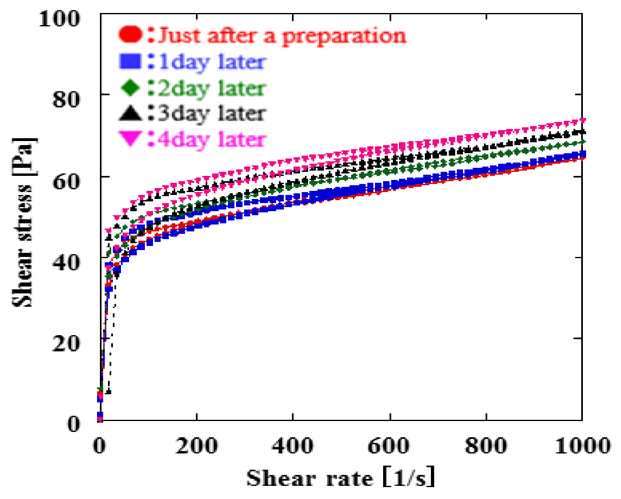


Fig.11 Flow curves of AES11E (PCA 0 mg/g Al_2O_3) slurry

Sediment test

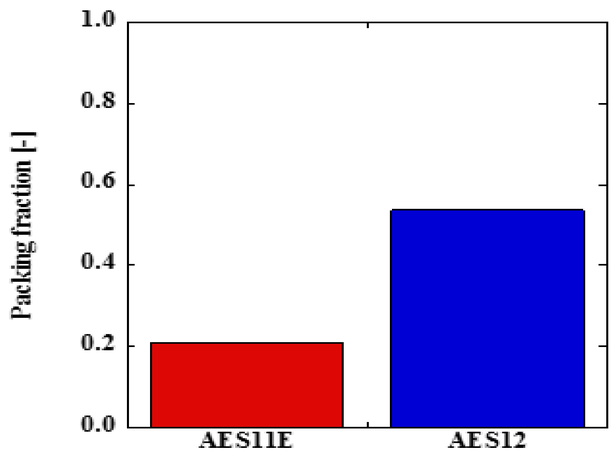


Fig.12 Packing fraction of sediment (PCA 1.6 mg/g Al_2O_3)

AES11E AES12

Fig.13 Images of final packing sedimentation

Polymer adsorbed amount

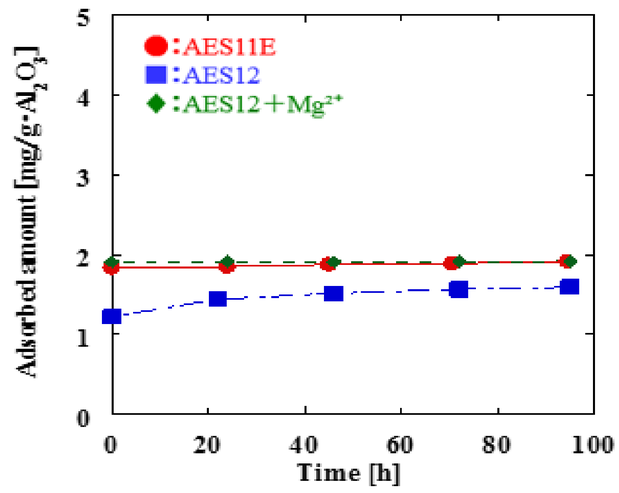


Fig.14 Adsorbed amount of polymer

Measurement of Magnesium ion elution

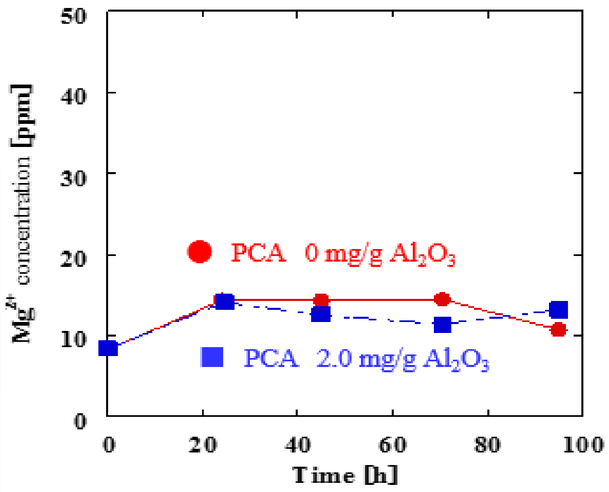


Fig.15 Magnesium ion concentration

4. Conclusion

It was found that the adsorbed amount of polymer and Magnesium ion concentration did not change over time.
These results indicated that ion elution should not be the main factor to change slurry properties.

Access

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