SCEJ 82nd Annual Meeting March 6-8,2017 Shibaura Institute of Technology Univ. , Toyosu Campus

■ Poster session B – Biochemical engineering , Environmental engineering ■ Hall P, Day 2, 09:20 - 11:20 ■ Paper ID : PB265 ■ Topic code : 13-b ■ Ack. number : 471

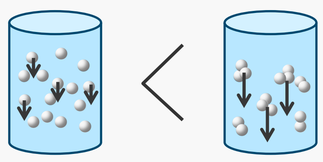
The effect of material and slurry conditions on the aggregation of particles in aqueous slurries by using D.C. electric field

Hosei U. (Stu. PCEF) Nagashima Hirotaka, (Ful) Mori Takamasa, (NISRI) Tsubaki Junichiro

Introduction

By forming aggregates, the efficiency of solid – liquid separation can be improved.

ex.1 sedimentation thickening

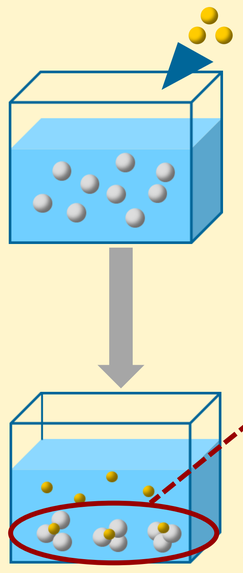


ex.2 filtration

■ quick separation
■ cost reduction

■ If you'd like to recycle fine particles in the liquid, you need to consider the method.

The conventional method

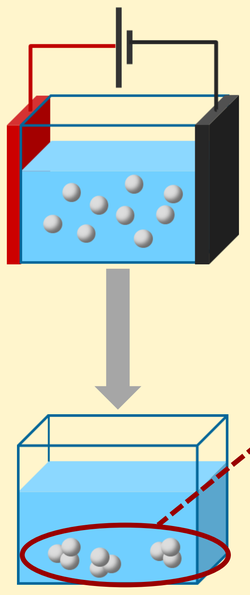


Addition of flocculants

flocculants become impurities

recycling is **difficult**

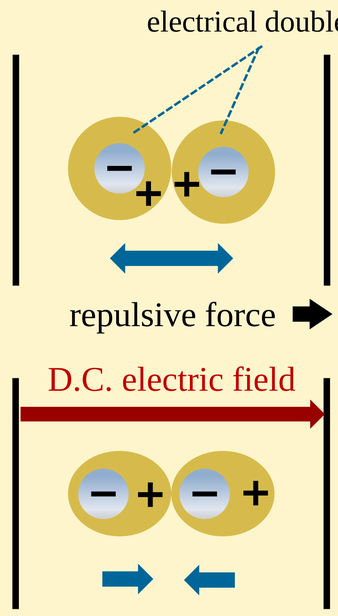
This research



Application of D.C. electric field

aggregates are pure

recycling is **easy**



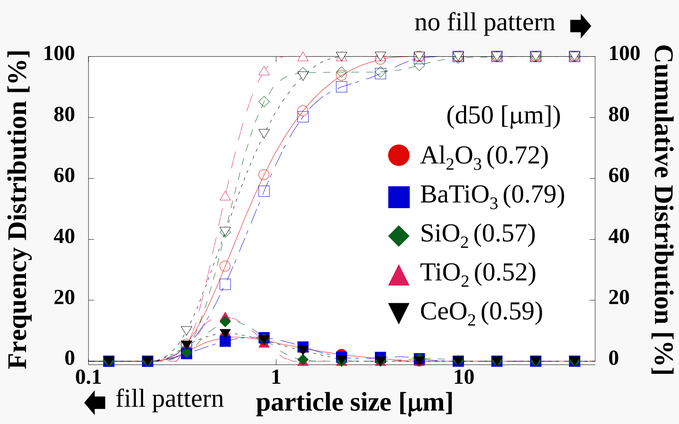
In this paper, we applied D.C. electric field on different types of particle slurry with different pH, and we discussed the particle aggregation efficiency.

The effect of material and slurry conditions

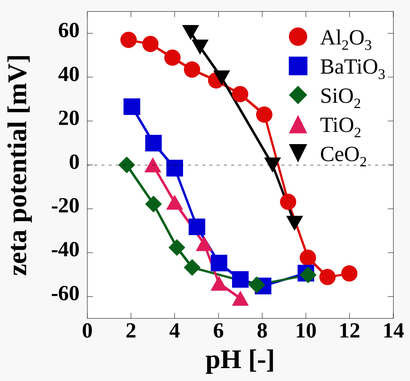
■ material information

powder	density [g·cm^{-3}]	relative permittivity [-]
Al_2O_3	3.96	9.6
$BaTiO_3$	6.08	1500
SiO_2	2.65	3.6
CeO_2	7.30	7
TiO_2	3.90	83 ~ 183

initial particle concentration	0.01 vol%
dispersion medium	deionized water
distance between electrodes	40 mm
voltage	5 V



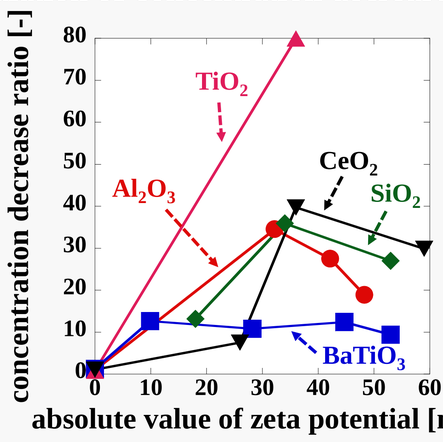
particle size distribution



zeta potential

■ the particle aggregation efficiency

measurement of supernatant concentration
➡ calculation of concentration decrease ratio



the aggregation efficiency

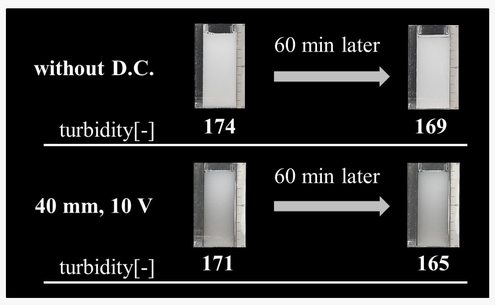
The aggregation efficiency decreases on the conditions below:

1. the slurry is **on the isoelectric point**

2. particles have **so high zeta potential**

■ when dispersion medium is oil

particle	Al_2O_3
dispersion medium	standard liquid for calibrating viscometer (1.94 mPa·s, at 20 ℃)

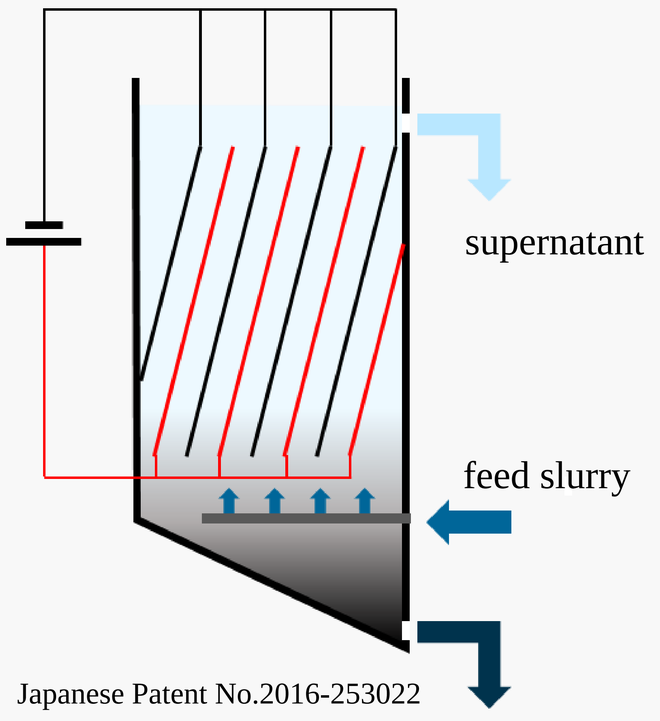


➡ No effect

In order to aggregate fine particles by D.C. electric field, **they need to form electrical double layer.**

Large scale processing

■ development of equipment



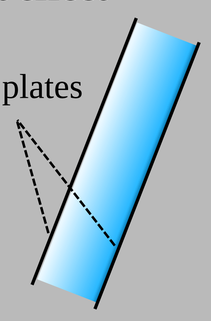
Japanese Patent No.2016-253022

D.C. electric field effect

+

Boycott effect

Inclined plates

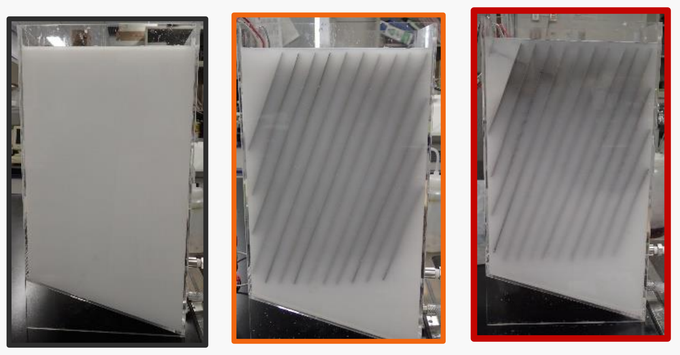


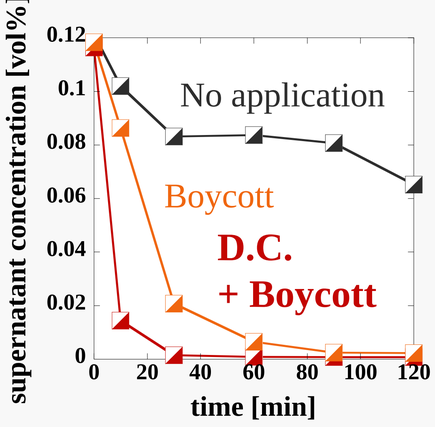
Inclined plates help fining layer to form.

■ Batch experiment

powder	Al_2O_3
dispersion medium	deionized water
pH [-]	7.0 (ζ = 32.2 mV)
distance between electrodes	20 mm
voltage	10 V

■ a state after 30 min from application





condition	initial sedimentation velocity ratio [-]
No application	1.0
Boycott effect	1.7
D.C. electric field + Boycott effect	5.5

0.1 vol% alumina slurry was concentrated to **6.6 vol%**

The continuous processing is possible on the feed rate of 100 mL·min^{-1}.

Conclusion

■ In the particle aggregation by using D.C. electric field, any particles can aggregate on the condition that they form electrical double layer, however, the aggregation efficiency decreases extremely when the slurry is on the isoelectric point.

Acknowledgement – This research is carried out under the support of Grant-in-aid for Scientific Research (B) 15H02849.

Address : 3-7-2 Kajino-cho, Koganei City, Tokyo, Japan Hosei Univ. Koganei campus E-4001 Mori Lab. **E-mail** : hirotaka.nagashima.6y@stu.hosei.ac.jp **Tel** : 042-387-6161