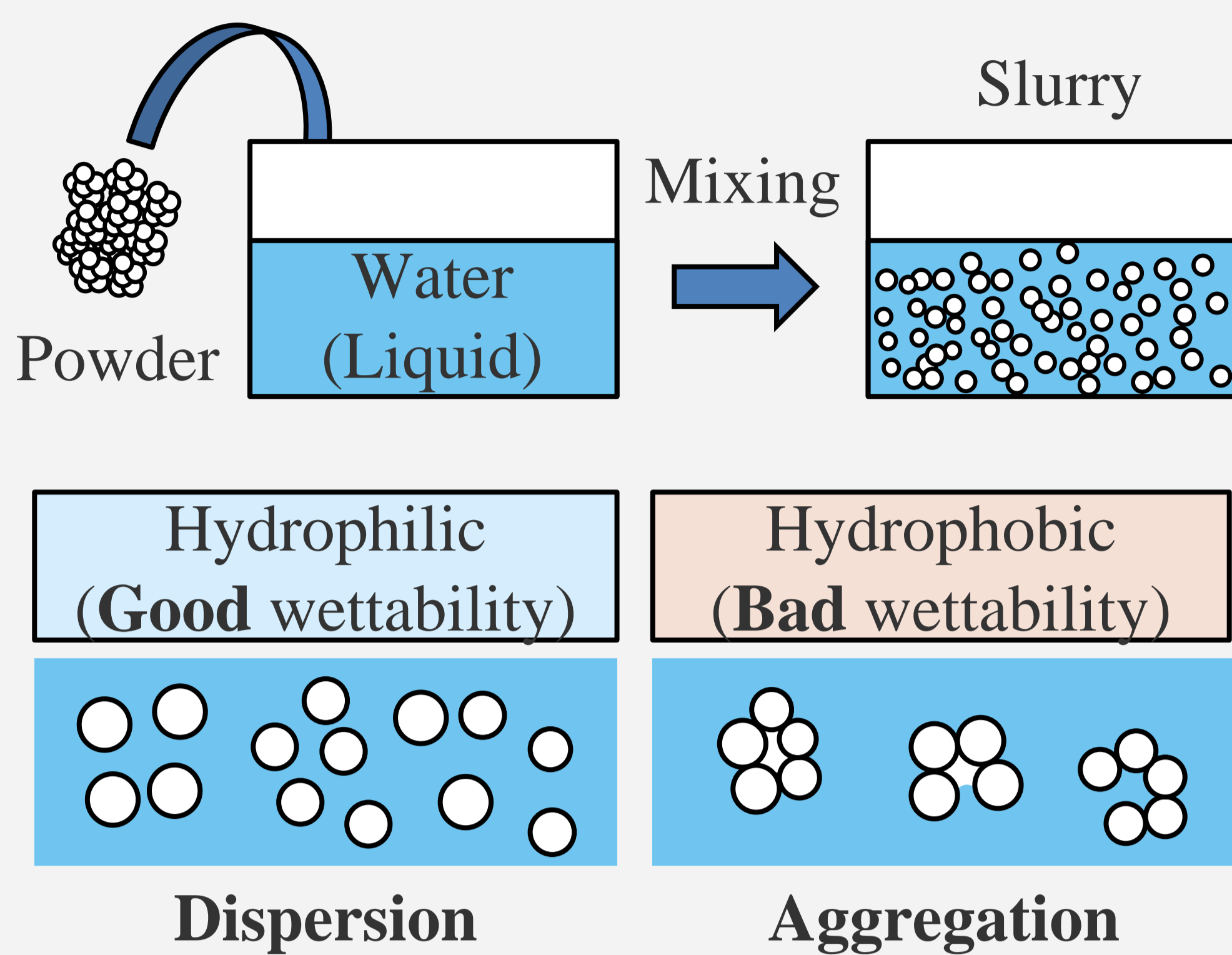


Development of a novel evaluation technique of powder's wettability by analyzing pressure rise due to liquid penetration into powder bed

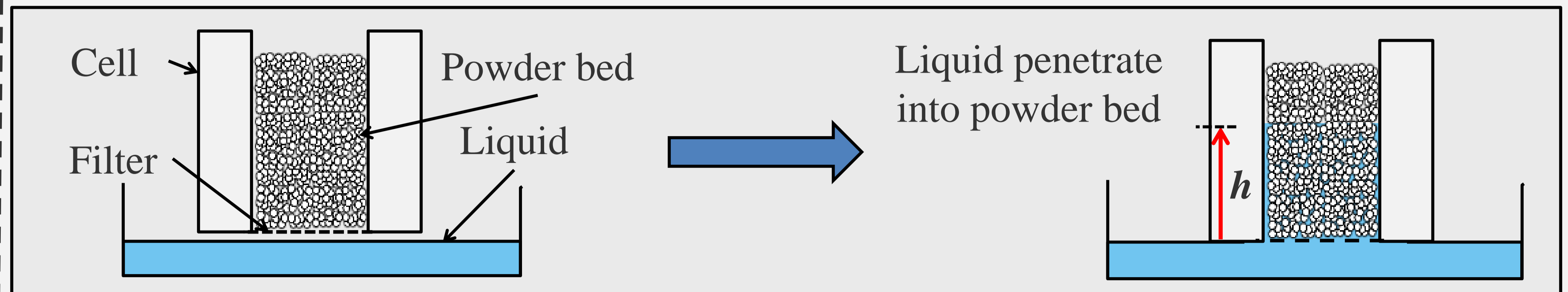
Hosei U. (Stu.) Ohno Keita, (Ful) Mori Takamasa, (NISRI) Tsubaki Junichiro

Introduction

Mixing powder and liquid



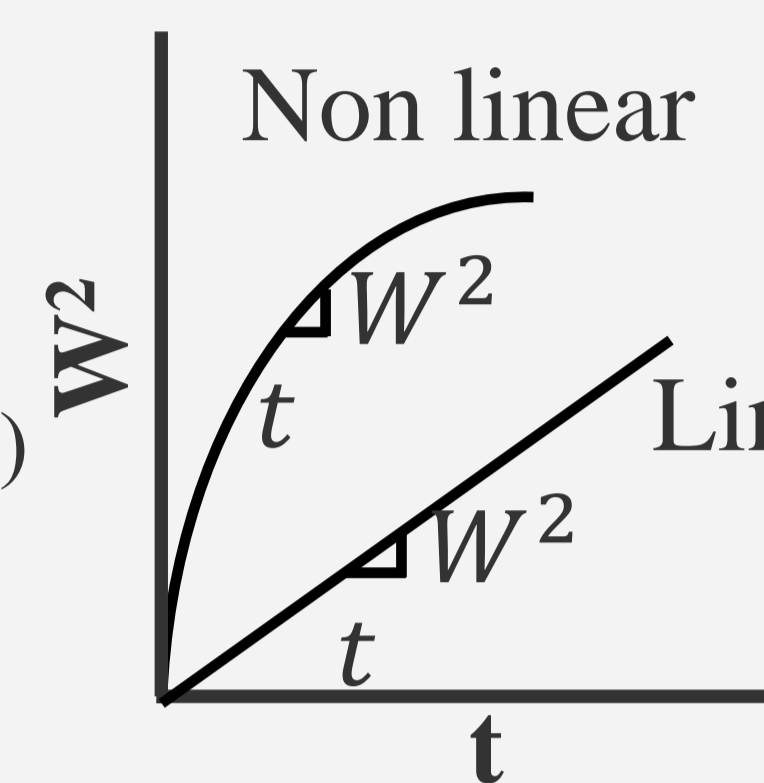
How to measure wettability for powder (Conventional technique)



$$\frac{dh}{dt} = \frac{r\gamma\cos\theta}{4\mu h} - \frac{r^2\rho g}{8\mu}$$

(1) Gravitation is neglected
⇒ Wrong equation (It can't be neglected)

$$\frac{W^2}{t} = (S \times \varepsilon \times \rho)^2 \times \frac{r\gamma\cos\theta}{2\mu}$$



(2) Analyzing the wettability with linear part

⇒ Real experimental results are non-linear

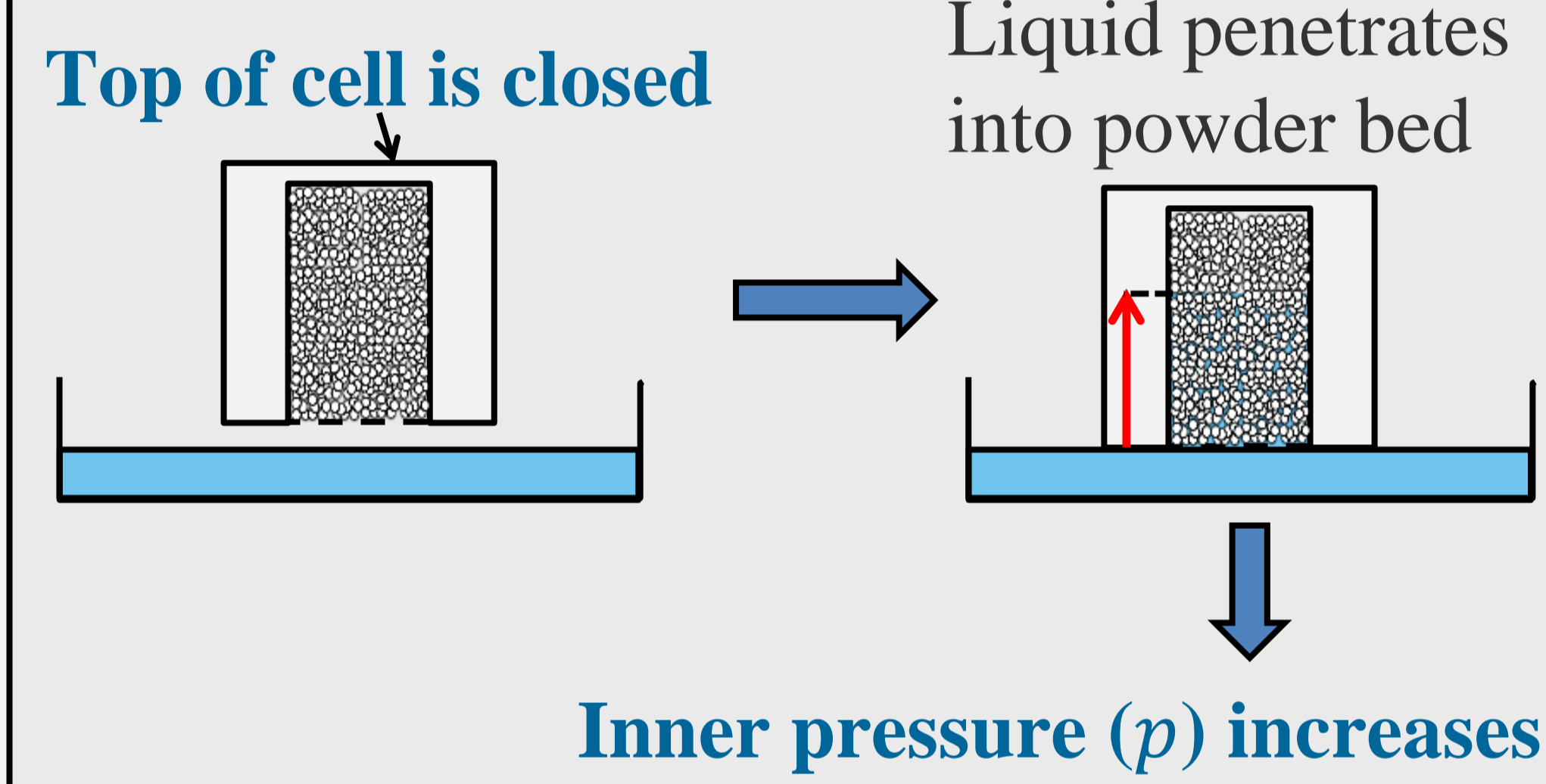
(3) Analyzing the wettability as a constant

⇒ Contact angle changes with the liquid rising velocity

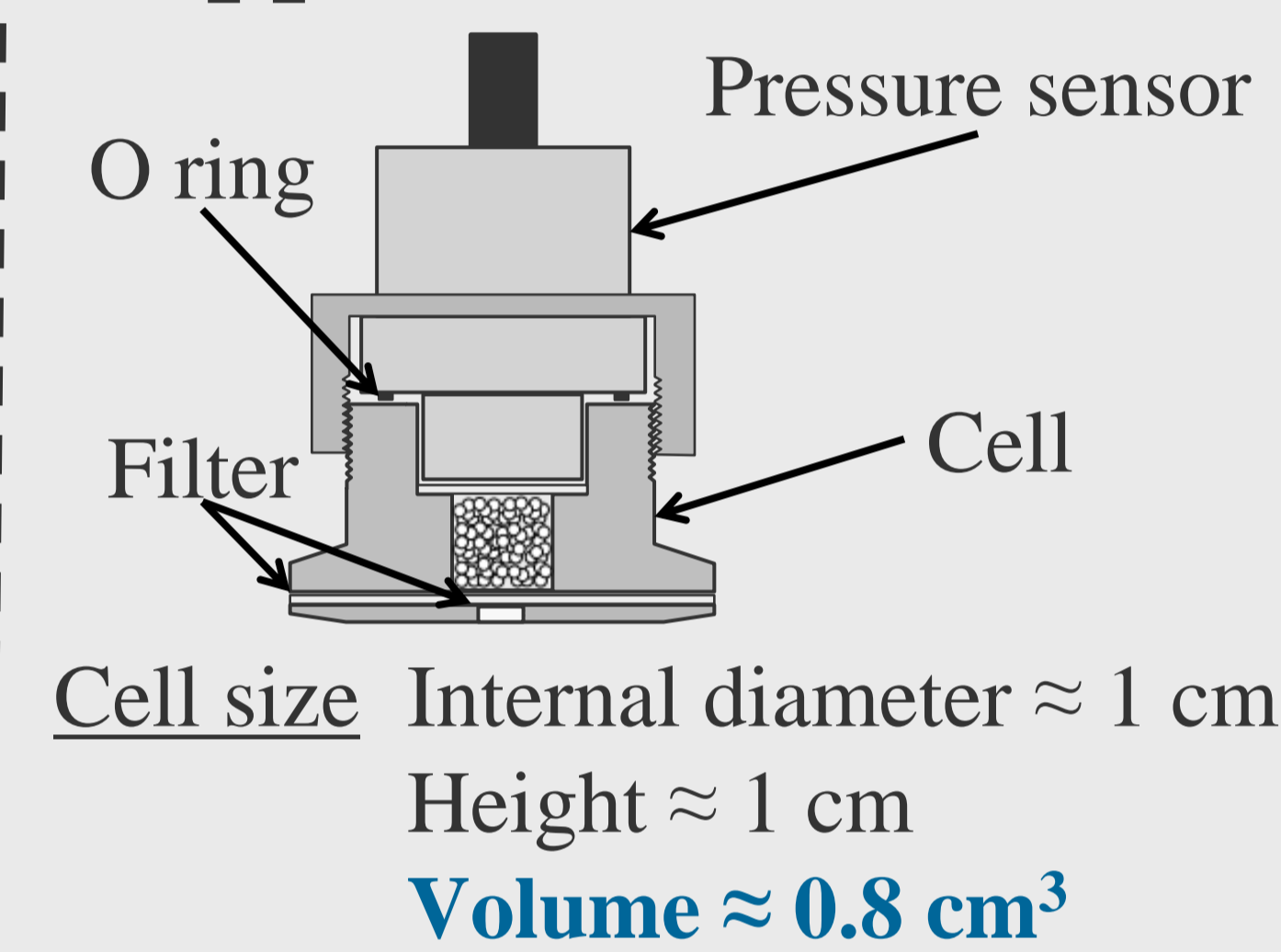
In this paper, in order to overcome these problems, we developed a **novel evaluation technique** of powder's wettability.

Novel evaluation technique

Measurement



Apparatus



$$\cos\theta = \frac{r}{2\gamma} \left\{ \left(\rho g + \frac{8\beta^2\mu PL\Delta p}{r^2 p^2 \Delta t} \right) \left(\frac{p-P}{p} L \right) - \rho g H + p - P \right\}$$

Measuring inner pressure and rising speed of inner pressure
⇒ Analyzing contact angle (θ) at each time

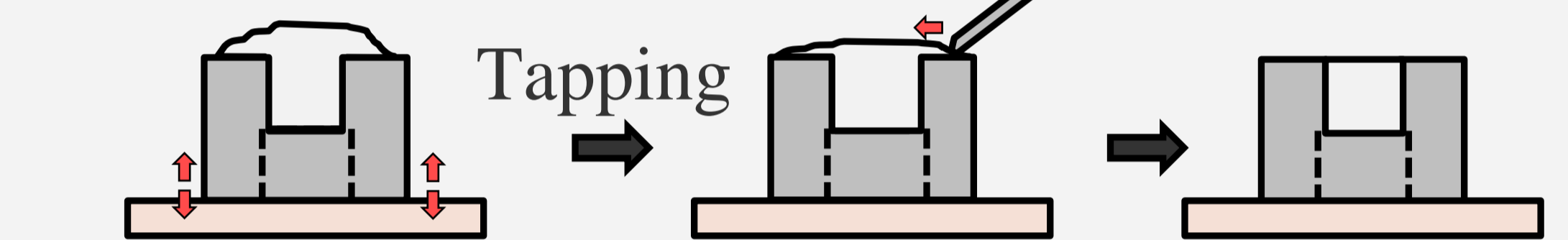
Preparation of experiment

Material

Al₂O₃ (Showa Denko K.K. d₅₀ = 9 μm)
CaCO₃ (APPIE JAPAN d₅₀ = 6 μm)

Packing methods

• Tapping ... 100 times

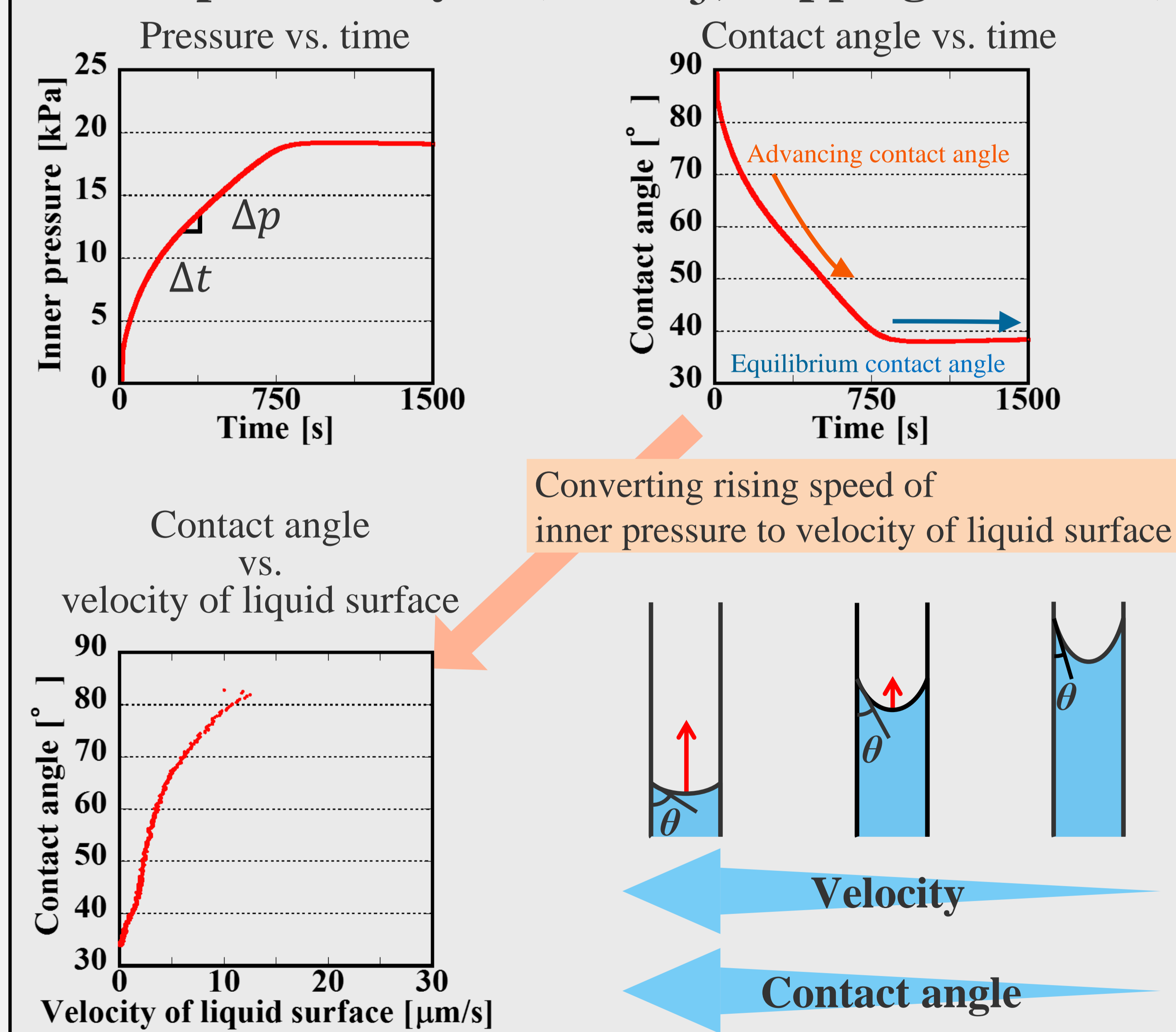


• Compressing and shearing ... 0.4 MPa

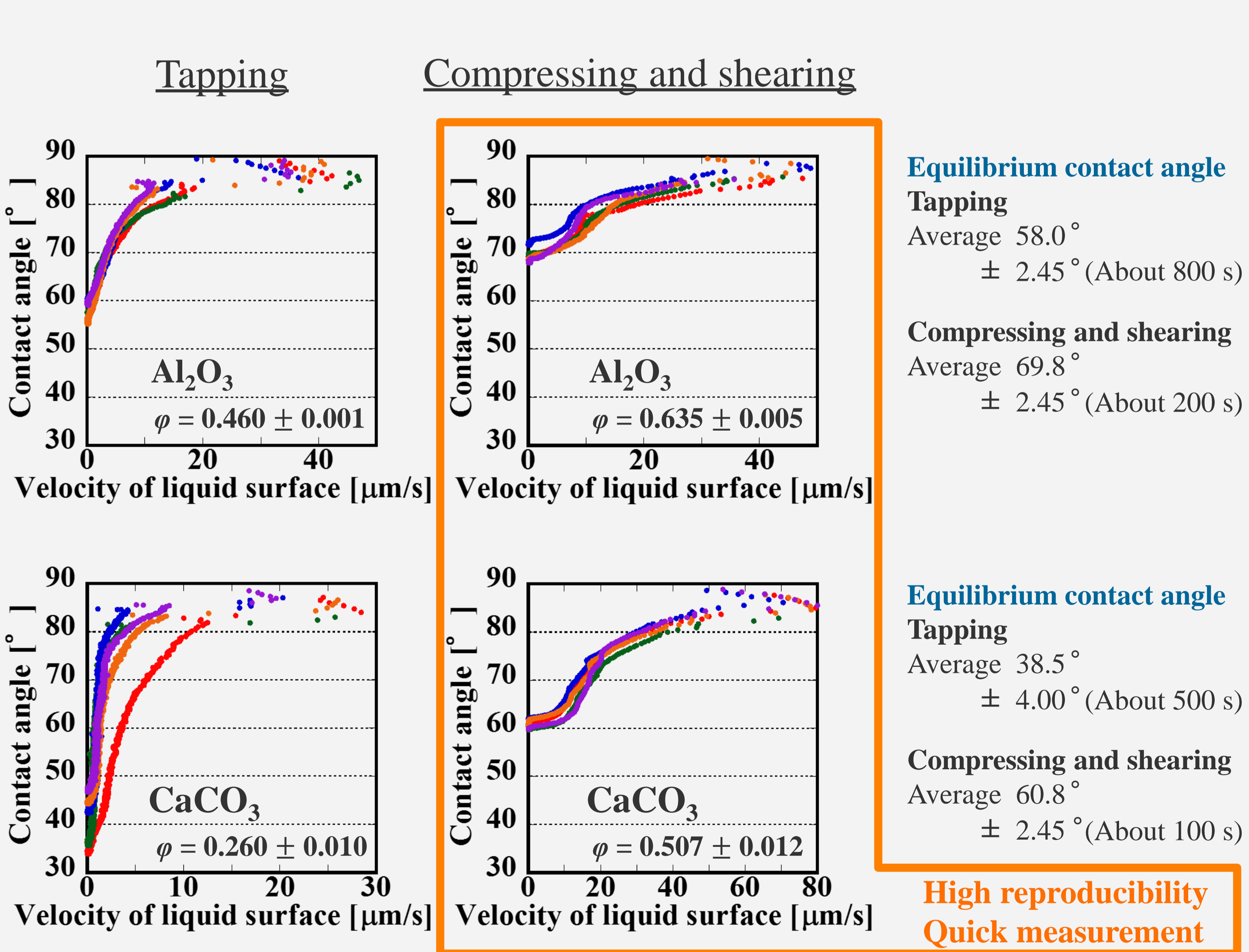


Results

Example of analysis (CaCO₃, Tapping 100 times)



Comparing two packing methods



Conclusions

- We developed novel evaluation technique of powder's wettability that can overcome problems of conventional techniques.
- It was found that compressing and method bed is more suitable than tapping method to make the powder bed homogeneous, resulting in good reproducibility of the measurement.