

# NMRパイプテクターの有無での ゼータ電位測定／ナノバブル測定

2021.10.15(金)

委託機関： 秋田県産業技術センター  
 発送日： 2021年 10月 12日(火)  
 測定日： 2021年 10月 14日(木)

## 試料の内訳

|   | 試料            | 作製日   | ゼータ電位測定<br>[mV] |        | ナノバブル測定<br>[バブル数/mL] |          | 備考 |
|---|---------------|-------|-----------------|--------|----------------------|----------|----|
|   |               |       |                 | 平均     |                      | 平均       |    |
| 1 | パイプテクター<br>有り | 10月7日 | -30.39          | -25.03 | 4.60E+07             | 4.25E+07 |    |
| 2 |               | 10月8日 | -19.66          |        | 3.90E+07             |          |    |
| 3 | パイプテクター<br>無し | 10月6日 | -16.72          | -16.81 | 2.50E+07             | 2.80E+07 |    |
| 4 |               | 10月8日 | -16.90          |        | 3.10E+07             |          |    |

- \* パイプテクターは、鉄管外部に設置し、鉄管中の循環水を採水。
- \* 試料は採水後、凍結処理し秋田県産業技術センターへ搬送。  
自然解凍後に測定を実施。



Operator (Report): ZetaView

Video Operator: ZetaView

**Sample Parameters**

Sample Name: PT2\_16\_L2\_Z  
 Comment: PS100nm 1:250,000, Sample Remarks0:  
 Sample Remarks1:  
 Sample Remarks2:  
 Electrolyte:  
 Temperature: 28.69 °C sensed  
 pH 7.0 entered  
 Conductivity: 39.71 µS/cm sensed

**Result**

Mobility:  $-2.53 \pm 0.07 \mu\text{m}/\text{sec}/\text{V}/\text{cm}$ , @ 25°C:  $-2.37 \mu\text{m}/\text{sec}/\text{V}/\text{cm}$   
 ZP Factor: 12.0 (Smoluchowski)  
 Zeta Potential @ 25 °C:  $-30.39 \pm 0.88 \text{ mV}$   
 Zeta Potential Distribution:  $-30.39 \text{ mV}$  FWHM 12.78 (SL1/2)  
 Concentration:  $4.6\text{E}+7$  Particles / mL  
 Dilution Factor: 1  
 Original Concentration:  $4.6\text{E}+7$  Particles / mL

**Measurement Parameters**

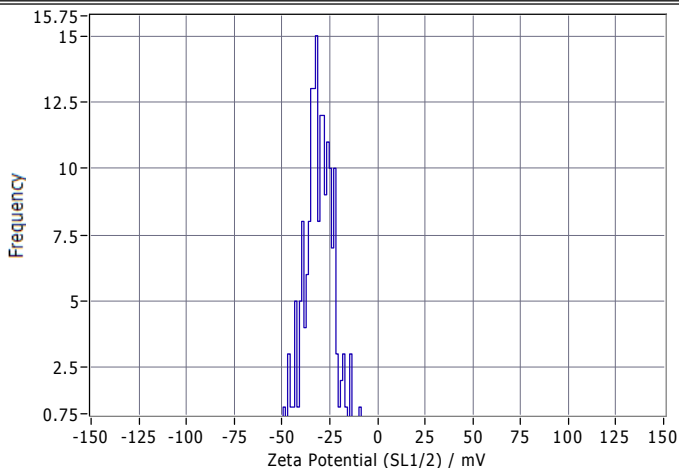
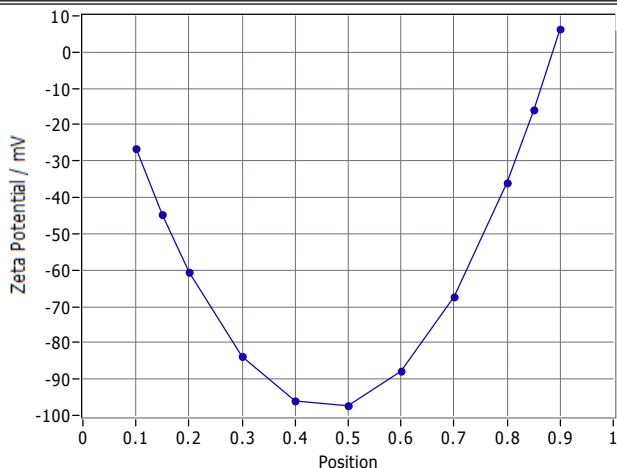
Cell S/N: Cell0179  
 Sensed Electric Field: 3.20 V/cm (continuous)  
**Measurement Mode: Profile 11 Positions**

**Quality**

Average Counted Particles per Frame: 120  
 Number of Traced Particles: 774  
 ΔSL: 28.81 mV  
 Profile Quality: 11 / 11

**Analysis Parameters**

Max Area: 1000, Min Area: 10, Min Brightness: 25

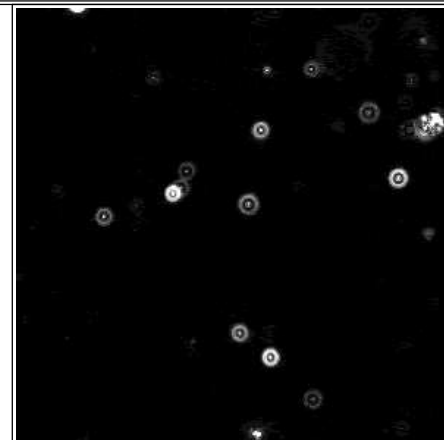


**Stationary Layers Zeta Potential / mV**

SL1: 0.149 -44.791  
 SL2: 0.851 -15.982

**Profile Details (Columns 2 ... 5 in mV)**

| Position | Positive V | Negative V | Average | Parabola Fit |
|----------|------------|------------|---------|--------------|
| 0.10     | -24.4      | -26.9      | -25.7   | -26.6        |
| 0.15     | -47.1      | -45.6      | -46.3   | -44.8        |
| 0.20     | -59.8      | -61.2      | -60.5   | -60.6        |
| 0.30     | -83.1      | -84.9      | -84.0   | -83.8        |
| 0.40     | -95.6      | -95.6      | -95.6   | -96.1        |
| 0.50     | -95.2      | -97.0      | -96.1   | -97.4        |
| 0.60     | -86.6      | -87.8      | -87.2   | -87.8        |
| 0.70     | -67.5      | -72.2      | -69.8   | -67.4        |
| 0.80     | -34.6      | -38.6      | -36.6   | -36.0        |
| 0.85     | -14.1      | -15.5      | -14.8   | -16.0        |
| 0.90     | 6.5        | 6.5        | 6.5     | 6.3          |



Comment

(Signature)

Operator (Report): ZetaView  
Video Operator: ZetaView

**Sample Parameters**

Sample Name: PT2\_16\_L3\_Z  
Comment: PS100nm 1:250,000, Sample Remarks0:  
Sample Remarks1:  
Sample Remarks2:  
Electrolyte:  
Temperature: 28.87 °C sensed  
pH 7.0 entered  
Conductivity: 37.77 µS/cm sensed

**Result**

Mobility:  $-1.64 \pm 0.04 \mu\text{m}/\text{sec}/\text{V}/\text{cm}$ , @ 25°C:  $-1.54 \mu\text{m}/\text{sec}/\text{V}/\text{cm}$   
ZP Factor: 12.0 (Smoluchowski)  
Zeta Potential @ 25 °C:  $-19.66 \pm 0.48 \text{ mV}$   
Zeta Potential Distribution:  $-19.66 \text{ mV}$  FWHM 10.99 (SL1/2)  
Concentration:  $3.9\text{E}+7$  Particles / mL  
Dilution Factor: 1  
Original Concentration:  $3.9\text{E}+7$  Particles / mL

**Measurement Parameters**

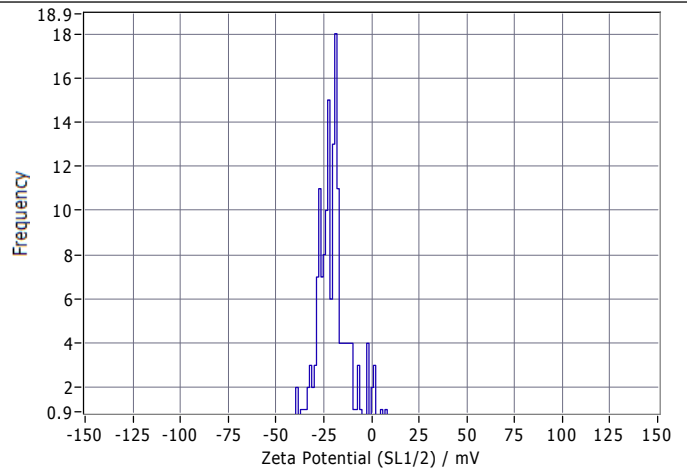
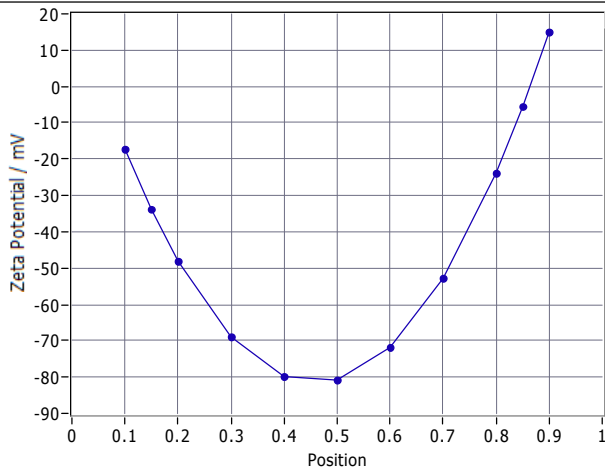
Cell S/N: Cell0179  
Sensed Electric Field: 3.28 V/cm (continuous)  
Measurement Mode: Profile 11 Positions

**Quality**

Average Counted Particles per Frame: 103  
Number of Traced Particles: 834  
ΔSL: 28.27 mV  
Profile Quality: 11 / 11

**Analysis Parameters**

Max Area: 1000, Min Area: 10, Min Brightness: 25



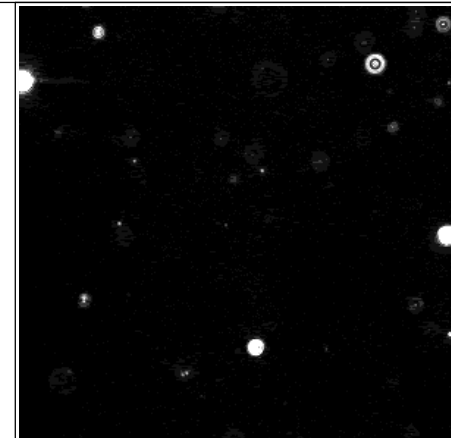
**Stationary Layers**

**Zeta Potential / mV**

SL1: 0.149                      -33.799  
SL2: 0.851                      -5.530

**Profile Details (Columns 2 ... 5 in mV)**

| Position | Positive V | Negative V | Average | Parabola Fit |
|----------|------------|------------|---------|--------------|
| 0.10     | -17.5      | -15.8      | -16.6   | -17.3        |
| 0.15     | -35.4      | -31.5      | -33.4   | -33.8        |
| 0.20     | -51.7      | -46.6      | -49.2   | -48.1        |
| 0.30     | -70.5      | -68.2      | -69.3   | -69.0        |
| 0.40     | -83.9      | -76.5      | -80.2   | -79.9        |
| 0.50     | -84.0      | -78.0      | -81.0   | -80.8        |
| 0.60     | -73.3      | -67.2      | -70.2   | -71.8        |
| 0.70     | -54.5      | -51.2      | -52.8   | -52.8        |
| 0.80     | -25.9      | -23.1      | -24.5   | -23.9        |
| 0.85     | -4.9       | -6.2       | -5.6    | -5.5         |
| 0.90     | 14.6       | 15.3       | 15.0    | 15.0         |



Comment

(Signature)

Operator (Report): ZetaView  
Video Operator: ZetaView

**Sample Parameters**

Sample Name: CONT\_16\_L3\_Z  
Comment: PS100nm 1:250,000, Sample Remarks0:  
Sample Remarks1:  
Sample Remarks2:  
Electrolyte:  
Temperature: 28.87 °C sensed  
pH 7.0 entered  
Conductivity: 37.63 µS/cm sensed

**Result**

Mobility:  $-1.41 \pm 0.07 \mu\text{m}/\text{sec}/\text{V}/\text{cm}$ , @ 25°C:  $-1.32 \mu\text{m}/\text{sec}/\text{V}/\text{cm}$   
ZP Factor: 12.0 (Smoluchowski)  
Zeta Potential @ 25 °C:  $-16.90 \pm 0.82 \text{ mV}$   
Zeta Potential Distribution:  $-16.90 \text{ mV}$  FWHM 7.50 (SL1/2)  
Concentration:  $3.1\text{E}+7$  Particles / mL  
Dilution Factor: 1  
Original Concentration:  $3.1\text{E}+7$  Particles / mL

**Measurement Parameters**

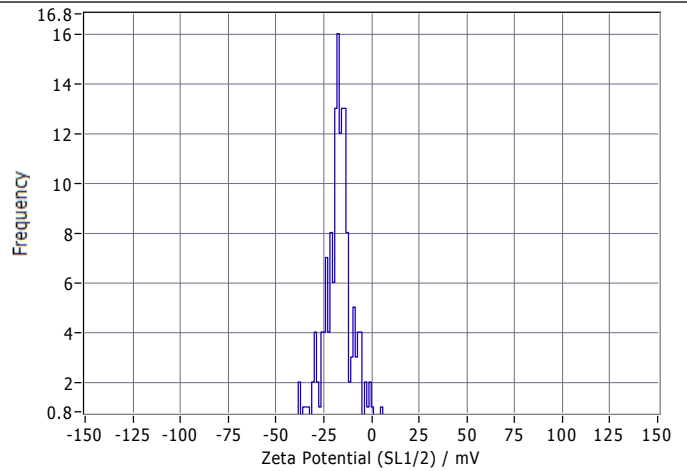
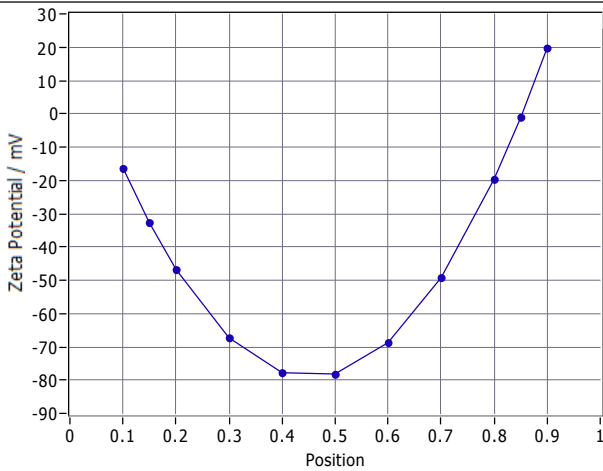
Cell S/N: Cell0179  
Sensed Electric Field: 3.31 V/cm (continuous)  
Measurement Mode: Profile 11 Positions

**Quality**

Average Counted Particles per Frame: 82  
Number of Traced Particles: 807  
ΔSL: 31.66 mV  
Profile Quality: 11 / 11

**Analysis Parameters**

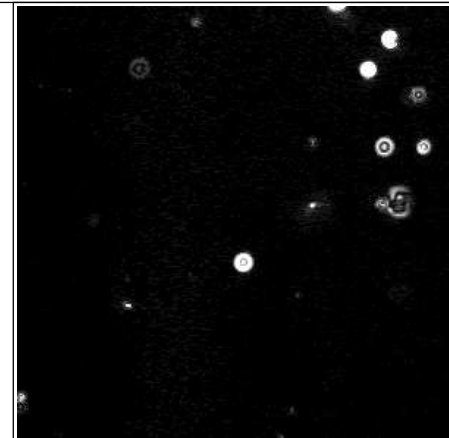
Max Area: 1000, Min Area: 10, Min Brightness: 25



| Stationary Layers | Zeta Potential / mV |
|-------------------|---------------------|
| SL1: 0.149        | -32.733             |
| SL2: 0.851        | -1.073              |

**Profile Details (Columns 2 ... 5 in mV)**

| Position | Positive V | Negative V | Average | Parabola Fit |
|----------|------------|------------|---------|--------------|
| 0.10     | -20.2      | -16.0      | -18.1   | -16.4        |
| 0.15     | -35.9      | -29.2      | -32.6   | -32.7        |
| 0.20     | -47.9      | -43.5      | -45.7   | -46.9        |
| 0.30     | -67.1      | -64.6      | -65.9   | -67.3        |
| 0.40     | -79.7      | -75.6      | -77.6   | -77.8        |
| 0.50     | -80.7      | -75.8      | -78.2   | -78.3        |
| 0.60     | -72.7      | -66.3      | -69.5   | -68.7        |
| 0.70     | -52.2      | -48.0      | -50.1   | -49.2        |
| 0.80     | -23.1      | -18.7      | -20.9   | -19.8        |
| 0.85     | -3.0       | 2.1        | -0.4    | -1.1         |
| 0.90     | 20.1       | 21.3       | 20.7    | 19.7         |



Comment

(Signature)

Operator (Report): ZetaView  
Video Operator: ZetaView

**Sample Parameters**

Sample Name: CONT\_16\_L1\_Z  
Comment: PS100nm 1:250,000, Sample Remarks0:  
Sample Remarks1:  
Sample Remarks2:  
Electrolyte:  
Temperature: 28.12 °C sensed  
pH 7.0 entered  
Conductivity: 37.85 µS/cm sensed

**Result**

Mobility:  $-1.38 \pm 0.07 \mu\text{m}/\text{sec}/\text{V}/\text{cm}$ , @ 25°C:  $-1.30 \mu\text{m}/\text{sec}/\text{V}/\text{cm}$   
ZP Factor: 12.1 (Smoluchowski)  
Zeta Potential @ 25 °C:  $-16.72 \pm 0.82 \text{ mV}$   
Zeta Potential Distribution:  $-16.72 \text{ mV}$  FWHM 4.10 (SL1/2)  
Concentration:  $2.5\text{E}+7$  Particles / mL  
Dilution Factor: 1  
Original Concentration:  $2.5\text{E}+7$  Particles / mL

**Measurement Parameters**

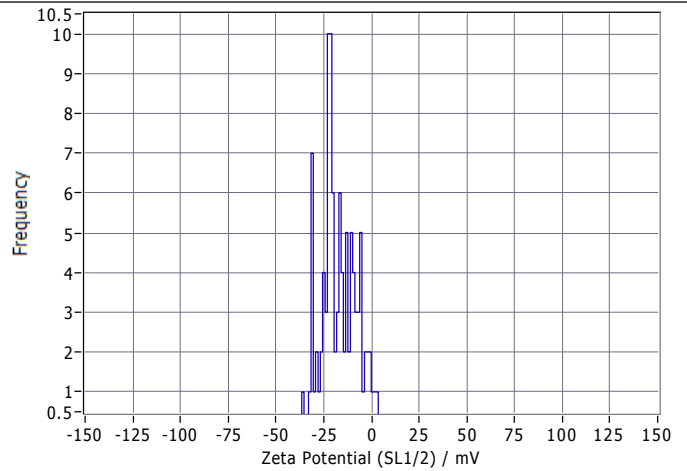
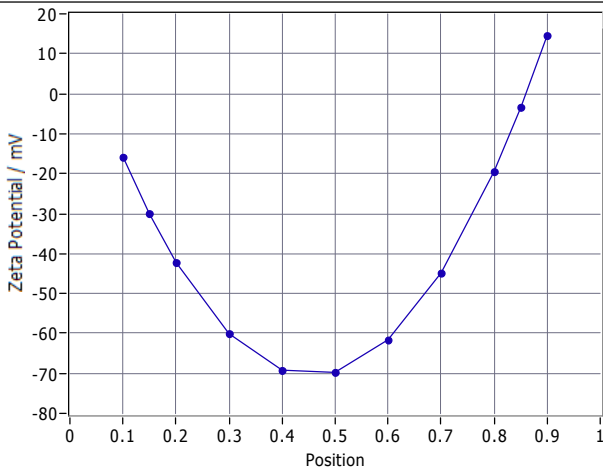
Cell S/N: Cell0179  
Sensed Electric Field: 3.38 V/cm (continuous)  
Measurement Mode: Profile 11 Positions

**Quality**

Average Counted Particles per Frame: 66  
Number of Traced Particles: 600  
ΔSL: 26.60 mV  
Profile Quality: 11 / 11

**Analysis Parameters**

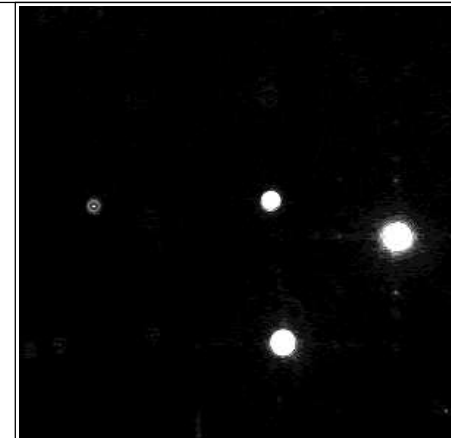
Max Area: 1000, Min Area: 10, Min Brightness: 25



| Stationary Layers | Zeta Potential / mV |
|-------------------|---------------------|
| SL1: 0.149        | -30.013             |
| SL2: 0.851        | -3.417              |

**Profile Details (Columns 2 ... 5 in mV)**

| Position | Positive V | Negative V | Average | Parabola Fit |
|----------|------------|------------|---------|--------------|
| 0.10     | -18.0      | -14.8      | -16.4   | -15.9        |
| 0.15     | -34.5      | -26.9      | -30.7   | -30.0        |
| 0.20     | -46.8      | -37.4      | -42.1   | -42.3        |
| 0.30     | -62.4      | -54.7      | -58.5   | -60.1        |
| 0.40     | -71.9      | -65.6      | -68.8   | -69.2        |
| 0.50     | -73.7      | -64.3      | -69.0   | -69.7        |
| 0.60     | -67.0      | -57.7      | -62.4   | -61.6        |
| 0.70     | -52.9      | -39.5      | -46.2   | -44.9        |
| 0.80     | -23.4      | -17.9      | -20.6   | -19.5        |
| 0.85     | -6.1       | -1.0       | -3.5    | -3.4         |
| 0.90     | 13.9       | 18.4       | 16.1    | 14.5         |



Comment

(Signature)