

2023 4 27

AZUL Energy

Li イオン電池より大容量で電圧を大幅に高めた  
レアメタルフリー空気電池を開発  
補聴器などに限られた用途が電気自動車やドローンに拡大する可能性示す

2 V

2.25 V

1.4 V

3.7 V

GX

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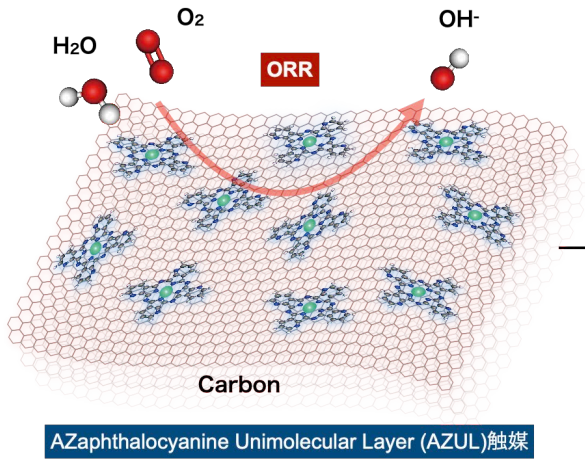
2 V

2023 4 24

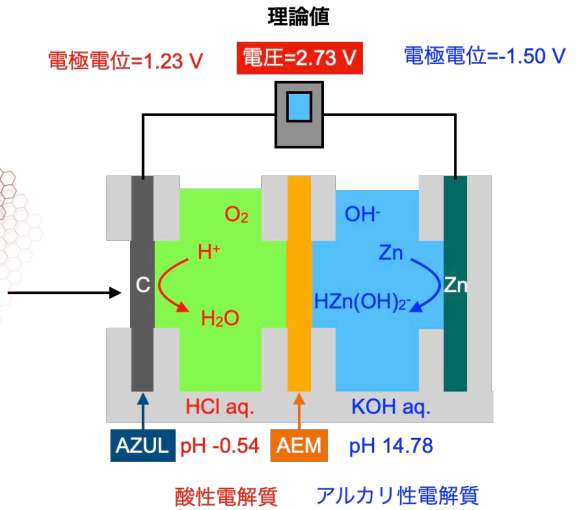
*APL Energy*

Featured Article

独自に開発したレアメタルフリー触媒

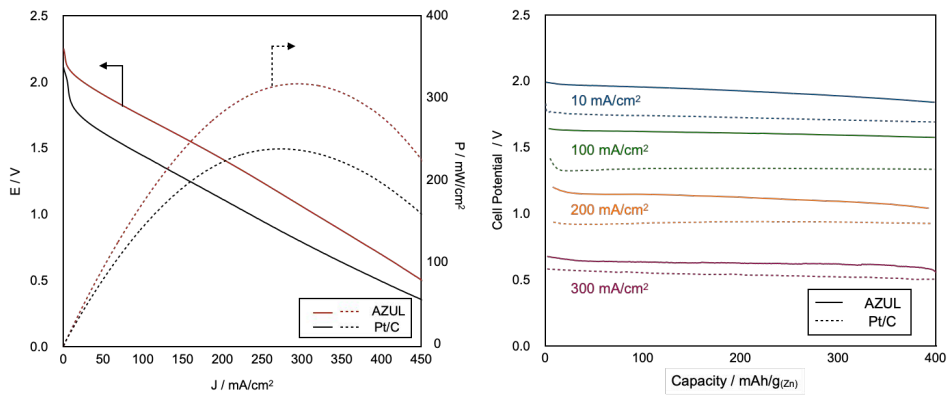


酸性・アルカリ性電解質タンデム型亜鉛空気電池セル



出力・放電特性

開放電圧：2.25 V, 最大出力：318 mW/cm<sup>2</sup>, 容量 1,139 Wh/kg<sub>(Zn)</sub>



1.

AZUL

1.

EV

<sup>1</sup> <sup>2</sup>

Lithium-Ion Battery, LIB

3.7 V LIB

1.4 V

Oxygen Reduction Reaction, ORR <sup>2</sup>

ORR

ORR

1.9 V

1.4 V

Pt/C

pH

Pourbaix

pH

<sup>3</sup>

<sup>3</sup>

AZUL <sup>1</sup>

ORR

<sup>1</sup>

Pt/C

AZUL

2.

AZUL

LSV

ORR

TurnOver

Frequency, TOF <sup>4</sup>

AZUL

3.5~6.1

Pt/C

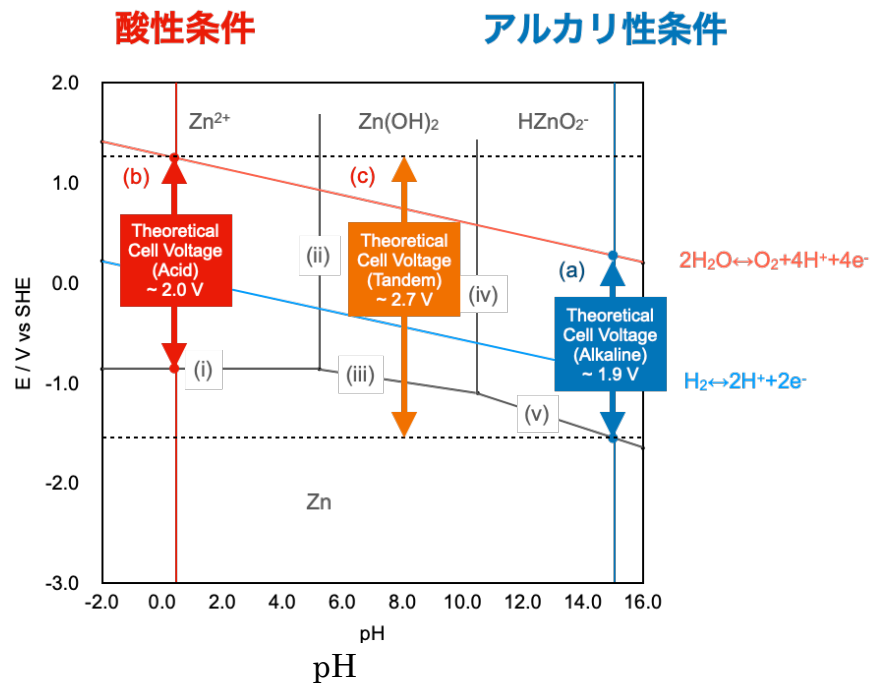
Pt

<sup>4</sup>

AZUL

Pt

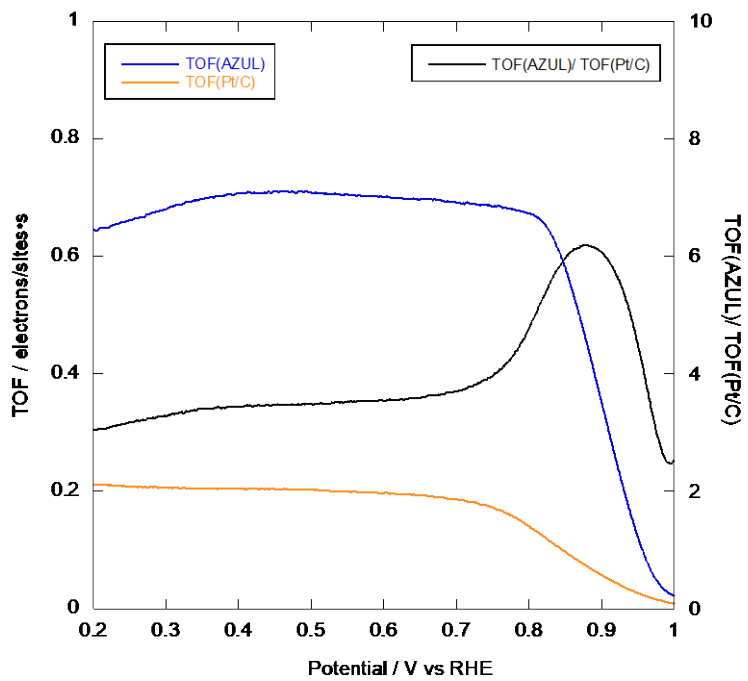




3 Pourbaix  
 ((i), (iii), (v) )

(a) (b)

(c)



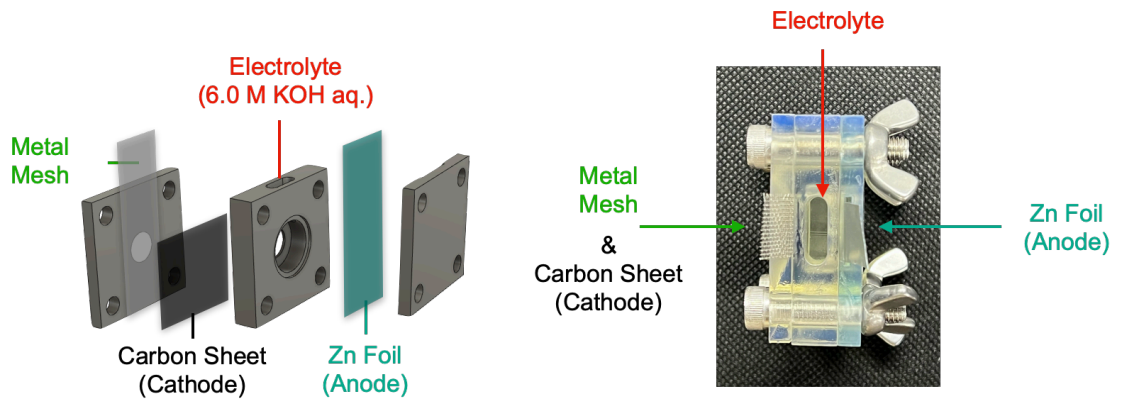
4.  
 AZUL( )  
 TOF

TOF

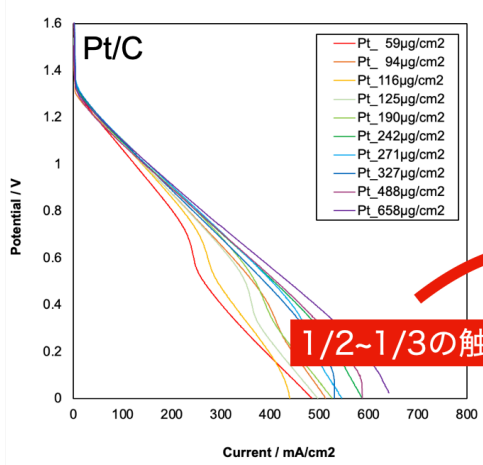
TOF  
 TOF

Pt/C

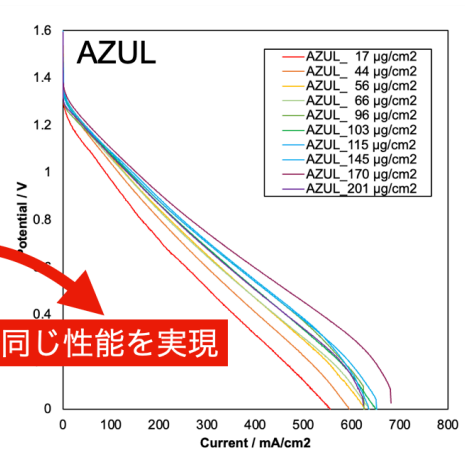
(a)



(b)



(c)

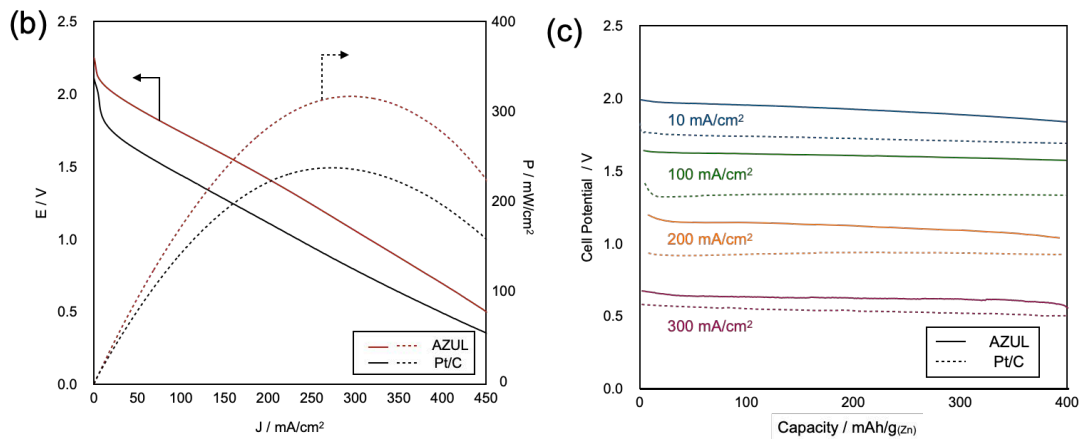
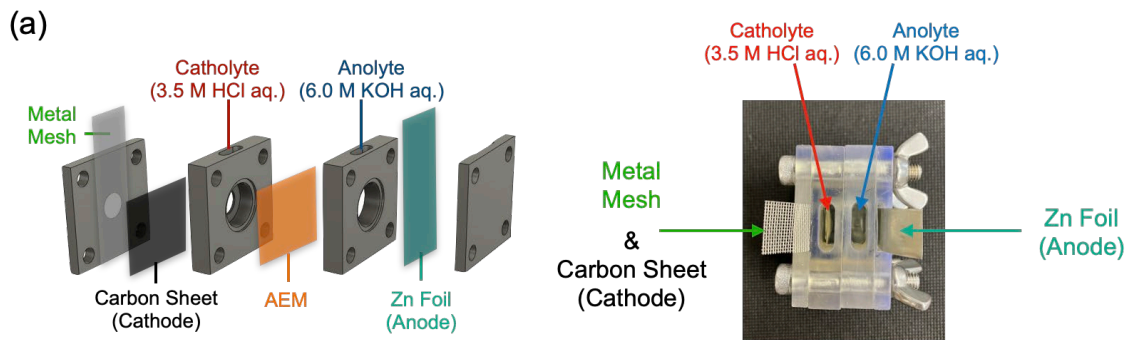


1/2~1/3の触媒量で同じ性能を実現

5.

6.0 M

(a) Pt/C (b) AZUL (c)



6. (a) Pt/C (b) AZUL (c)

<sup>1</sup> H. Yabu\*, K. Nakamura, Y. Matsuo, Y. Umejima, H. Matsuyama, J. Nakamura and K. Ito, "Pyrolysis-free Oxygen Reduction Reaction (ORR) Electrocatalysts Composed of Unimolecular Layer Metal Azaphthalocyanines Adsorbed onto Carbon Materials", *ACS Applied Energy Materials*, **2021**, 4(12), 14380-14389.

1

( ) ( ) W

(W/kg) kg kg

Wh/kg kg

Wh 1968 David V. Ragon

2 Oxygen Reduction Reaction, ORR (H<sub>2</sub>O<sub>2</sub>) OH<sup>-</sup>

3 Pourbaix

pH 2

1938 Marcel Pourbaix

4 TurnOver Frequency, TOF  
( )

$$\frac{[A \cdot g_{\text{catalyst}}^{-1}]}{[\text{sites} \cdot g_{\text{catalyst}}^{-1}] X} = \text{TOF} \frac{[\text{electrons} \cdot \text{sites}^{-1} \cdot \text{s}^{-1}] X}{[C \cdot \text{electrons}^{-1}]}$$

5)

, Kosuke Ishibashi, Koju Ito, Hiroshi Yabu\*

Rare-metal-free Zn-Air Batteries with Ultrahigh Voltage and High Power Density Achieved by Iron Azaphthalocyanine Unimolecular Layer (AZUL) Electrocatalysts and Acid/Alkaline Tandem Aqueous Electrolyte Cells

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