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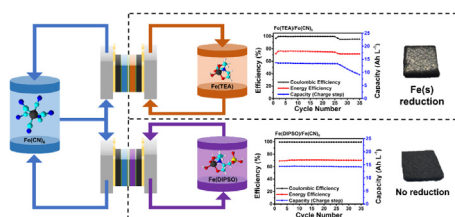
# All iron aqueous redox flow batteries using organometallic complexes consisting of iron and 3-[bis (2-hydroxyethyl)amino]-2-hydroxypropanesulfonic acid ligand and ferrocyanide as redox couple

Mingyu Shin<sup>a,1</sup>, Chanho Noh<sup>a,1</sup>, Yongjin Chung<sup>b</sup>, Yongchai Kwon<sup>a,c,\*</sup><sup>a</sup> Graduate School of Energy and Environment, Seoul National University of Science and Technology 232 Gongneung-ro, Nowon-gu, Seoul 01811, Republic of Korea<sup>b</sup> Department of Chemical and Biological Engineering, Korea National University of Transportation, 50 Daehak-ro, Chungju, Chungbuk 27469, Republic of Korea<sup>c</sup> Department of Chemical and Biomolecular Engineering, Seoul National University of Science and Technology, Nowon-gu, Seoul 01811, Republic of Korea

## HIGHLIGHTS

- Fe(DIPSO) consisting of Fe and DIPSO ligand is suggested as negative active species.
- Fe(DIPSO) and Fe(CN)<sub>6</sub> are selected as redox couple for RFB.
- Fe(DIPSO) has a strong resistance against the reduction to Fe(s).
- Cell voltage of the redox couple is 1.37 V.
- RFB using new redox couple has 14.4 Ah L<sup>-1</sup> (capacity) and 93.2 mW cm<sup>-2</sup> (power density).

## GRAPHICAL ABSTRACT



## ARTICLE INFO

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## ABSTRACT

The Organometallic complex consisting of iron and 3-[bis (2-hydroxyethyl) amino]-2-hydroxypropanesulfonic acid (DIPSO) ligand (Fe(DIPSO)) is newly suggested as negative active species for redox flow battery (RFB), while ferrocyanide (Fe(CN)<sub>6</sub>) is used as positive active species. When the two active species are used, cell voltage of the RFB reaches 1.37 V. In a comparison of Fe(DIPSO) and Fe-triethanolamine (Fe(TEA)), redox potential of the two complex is similar as  $-1.05$  V (vs. Ag/AgCl), but the Fe(DIPSO) does not suffer from the reduction to metallic iron (Fe(s)) that is the general problem of iron based organometallic materials, meaning that Fe(DIPSO) has a strong resistance against the reduction to Fe(s) and this can induce obvious enhancements in the performance and stability of RFB using the complex. Actually, when RFB using 0.5 M Fe(DIPSO) and Fe(CN)<sub>6</sub> is operated at 80 mA cm<sup>-2</sup>, its discharge capacity is 14.4 Ah L<sup>-1</sup>, power density is 93.2 mW cm<sup>-2</sup> and energy efficiency is 70% and even after 100 cycle, while the capacity preserves well with the decay rate of 0.12% per cycle. In contrast, in the RFB using 0.5 M Fe(TEA) and Fe(CN)<sub>6</sub>, although initial discharge capacity is 13.4 Ah L<sup>-1</sup>, decay rate is very high as 0.96% per cycle with a rapid decrease of columbic efficiency from 99.5 to 95.4% for the initial 25 cycle. This is due to the conversion of ferrous/ferric core to Fe(s) occurring at Fe(TEA) during cycle. Based on that, it is revealed that the RFB using 0.5 M Fe(DIPSO) and Fe(CN)<sub>6</sub> shows excellent performance and stability demonstrated as high power and energy densities.

\* Corresponding author at: Graduate School of Energy and Environment, Seoul National University of Science and Technology 232 Gongneung-ro, Nowon-gu, Seoul 01811, Republic of Korea.

E-mail address: [kwonyc@seoultech.ac.kr](mailto:kwonyc@seoultech.ac.kr) (Y. Kwon).

<sup>1</sup> M. Shin and C. Noh contributed equally to this work.

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