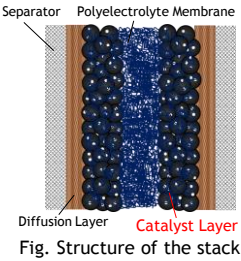
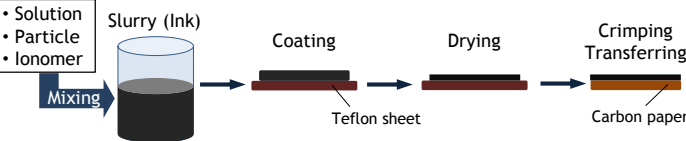


Effect of Adsorbed Amount of Ionomer on the Microstructure of PEFC Electrode

(Hosei U.) O Shohei Moriyama Takamasa Mori

Introduction



The performance of the battery is affected by

- Gas Diffusion
- Redox reaction
- Removal of Water

It is important that evaluating the characteristics of the slurry.

However, it has not yet been fully elucidated correlation of the structure and the battery performance.

Purpose

Clarifying the relationship between the dispersibility of carbon, adsorption amount of ionomer and catalyst structure

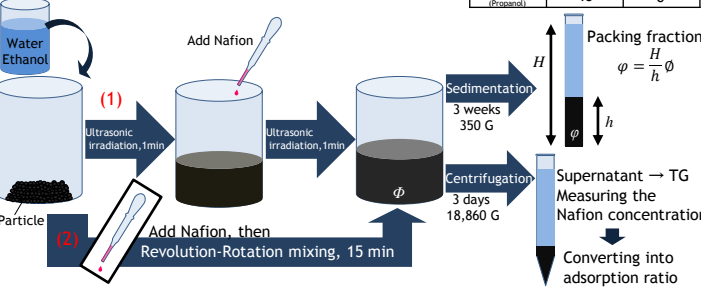
Experiments 1

Packing Density and Adsorption Amount

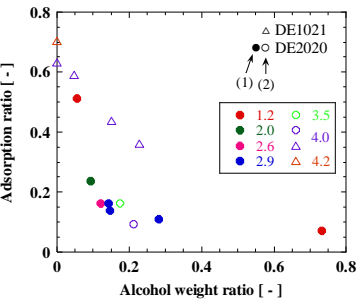
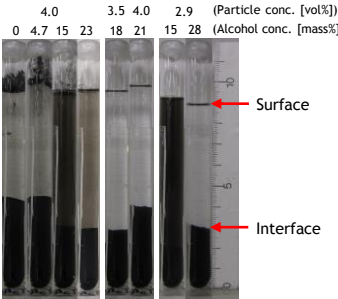
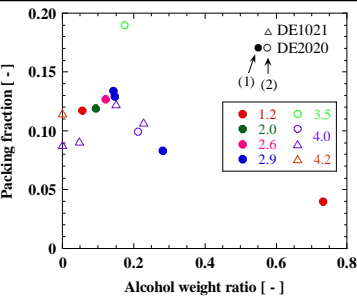
Particle : Pt-C (Pt:C=29:71, nominal diameter 12 nm, TKK)
Ionomer : Nafion dispersion sol. (DE2020 (1) • DE1021 (2), Dupon)
Solution : Water and Ethanol

Particle conc. : 1.2 - 2.9 vol% (1) • 3.5 - 4.2 vol% (2)
I/C balance : 1.0 [-]
Parameter : Alcohol concentration in the solution

Table Component contents [mass%]	DE2020	DE1021
Polymer	21	11
Water	33	89
VOC (Propanol)	46	0



Results 1



-Packing Density-
The highest packing fraction obtained around 15 mass% of alcohol in the solution.

-Adsorption Amount-
The more alcohol concentration in the solution, the less adsorption amount of nafion.

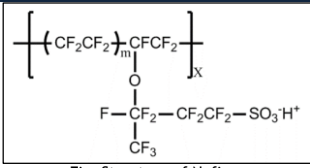
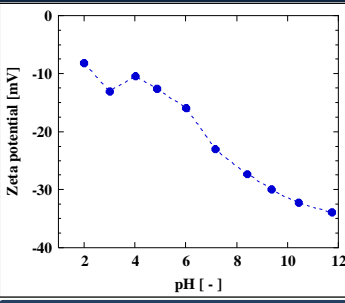


Fig. Structure of Nafion

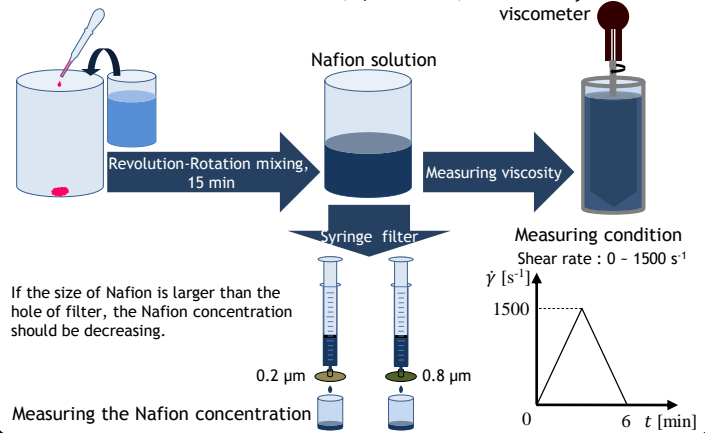
From the fact that the zeta potential of the carbon is negative at wide range of pH, Nafion can not be adsorbed electrostatically.

These results suggest that Nafion adsorbed onto Pt-C by hydrophobic interaction.

Experiments 2

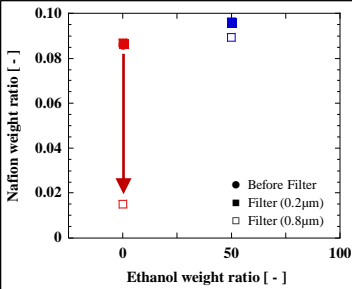
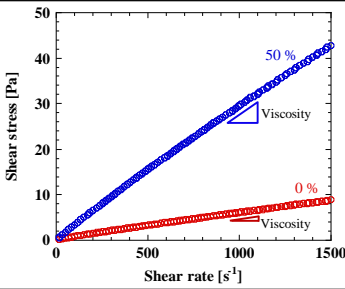
Morphology of Nafion in the Solution

Ionomer : Nafion dispersion sol. (DE1021, Dupon)
Solution : Water and Ethanol (Ethanol : 0, 50 mass%)
Ionomer concentration : 9 mass% (Equal to Ex.1)



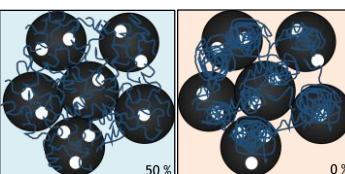
If the size of Nafion is larger than the hole of filter, the Nafion concentration should be decreasing.

Results 2



Viscosity of Ethanol solution (25 °C)
0% : 0.9 mPa · s, 50% : 2.5 mPa · s
(Kagakukougaku binran, vol. 4)

These results indicate that Nafion make aggregates in water rich solution, while Nafion disperse well in alcohol rich solution.



From these results, it is probable that the network structure of Nafion is not well formed, suggesting that the battery performance should be fall off.

Conclusion

- By changing the alcohol concentration in the solvent, it was possible to control the adsorption amount and dispersibility. Further, even if adsorption amount of the ionomer increases, that not necessarily packing density increases revealed.
- Dispersibility and packing density of the carbon, as well as adsorption of ionomer, can also influenced the structure of the ionomer was suggested.

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