電気化学的メチルシクロヘキサン酸化反応を志向した膜・電極接合体におけるイオン交換膜の開発

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Development of Ion Exchange Membranes in Membrane-Electrode Assemblies Intended for Electrochemical Methylcyclohexane Oxidation Reaction ([1]*Faculty of Engineering, Shinshu University,* [2]*Research Initiative for Supra-Materials)* ○Akinobu Yashiki,[1] Ryosuke Nakae,[1] Yosuke Kageshima,[1,2] Katsuya Teshima,[1,2] Hiromasa Nishikiori[1,2]

The construction of a fuel cell system that can generate electricity through direct electrochemical oxidation of methylcyclohexane (MCH) will contribute to the improved efficiency of hydrogen utilization based on the organic chemical hydride process. In this study, we developed the catalyst materials and ion exchange membranes that composed the membrane-electrode assembly (MEA) to improve the MCH oxidation performances and selectivity for toluene (TL) generation.

Total charge-potential curves of the MEAs consisting of Nafion membrane and Pt catalysts loaded on carbon black (Pt/C) or boron-doped carbon nitride (Pt/BCN) during the MCH oxidation reaction are shown in Fig. 1. It was found that the faradaic efficiency (FE) of Pt/C for TL generation was quite low, while that of Pt/BCN was relatively high, approximately 58%. In the presentation, we will also discuss the effects of the type of membrane on the MCH oxidation performances as well as the FE for TL production.

Keywords : Organic Chemical Hydride; Methylcyclohexane; Fuel Cell; Electrocatalyst; Dehydrogenation Reaction

メチルシクロヘキサン(MCH)の電気化学的な直接酸化反応によって発電可能な燃料電池系を構築することが出来れば、有機ハイドライド法における水素の利用効率向上に資すると期待できる。本研究では、膜・電極接合体(MEA)を構成する触媒材料やイオン交換膜の改良による、MCH 酸化特性及びトルエン(TL)生成の選択率向上を試みた。カーボン担持白金触媒(Pt/C)またはホウ素ドープ窒化炭素担持白金触媒(Pt/BCN)と Nafion 膜からなる MEA の、MCH 酸化反応駆動時における電荷量―電位曲線を Fig. 1 に示す。Pt/C は TL 生成のファラデー効率(FE)が 1%と極めて低いのに対し、Pt/BCN は 58%程度と比較的高い FE を示すことが分かった。発表では、隔膜の種類が MCH 酸化特性や TL 生成の FE に及ぼす影響についても議論する。

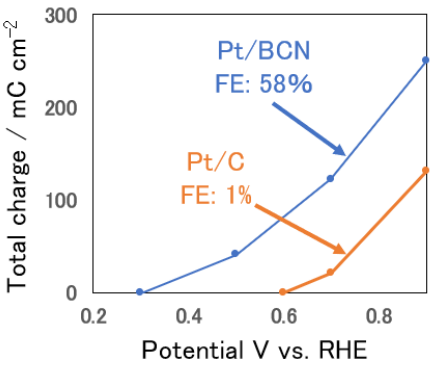

Fig. 1 Total charge passed during the 300 s-MCH oxidation reaction using the MEAs consisting of Pt/C or Pt/BCN as a function of applied potential.