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Improvement of cell performance in catalyst layers with silica-coated Pt/carbon catalysts for polymer electrolyte fuel cells

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HIGHLIGHTS

- CL for silica-coated catalysts with low ionomer are prepared by inkjet method.
- The coverage of Pt with silica layers improves dispersion in the catalyst ink.
- The silica-coated Pt catalysts with low ionomer show high performance on MEA.
- Silica coating of Pt catalysts enhances performance under RH below 60% conditions.

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ABSTRACT

Carbon-supported Pt catalysts (Pt/Cs) for use of cathode catalyst layers (CLs) for PEFCs were covered with silica layers in order to improve performance. CLs with low ratio of ionomer to carbon (I/C) for Pt/C and silica-coated Pt/C were fabricated using an inkjet printing (denoted as Pt/C(IJ) and SiO₂-Pt/C(IJ)) to reduce oxygen diffusion resistance. Compared to Pt/C(IJ), SiO₂-Pt/C(IJ) ink maintained good dispersion and high stability under the lower I/C. The performance of SiO₂-Pt/C(IJ) was significantly higher than Pt/C(IJ) at 0.6 V under all humidity conditions. In particular, the performance of SiO₂-Pt/C(IJ) under low humidity conditions showed noticeable improvement regardless of current density area. From FIB-SEM, it was confirmed that the morphologies and porosities of both catalysts were the same. Thus, these results indicate that oxygen diffusion resistance, related to structure of CLs, hardly affects the performance, whereas improved performance is attributed to increased proton conductivity by silica layers containing hydrophilic groups.

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