Effect of Cobalt Cation Concentration on PEMFC Electrode Performance

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Metal alloy catalysts, such as Pt-Co, reduce the activation energy of oxygen reduction reaction, leading to improved proton exchange membrane fuel cell (PEMFC) performance. However, leaching of non-noble elements contaminates the ionomer and membrane, which has a negative impact on the durability of PEMFCs. For the commercial success of metal alloy catalysts, understanding the mechanisms of how cation contamination affects PEMFC performance is crucial. Here, we investigate the effect of cobalt cation contamination effects through intentional doping of decal electrodes. Electrochemical testing results are coupled with membrane conductivity and water uptake measurements, as well as impedance modeling to identify the mechanisms of performance loss. Our results provide a comprehensive understanding of how cation contamination affects performance, which can inform mitigation strategies and new materials development that can enable the use of metal alloy catalysts in PEMFCs.

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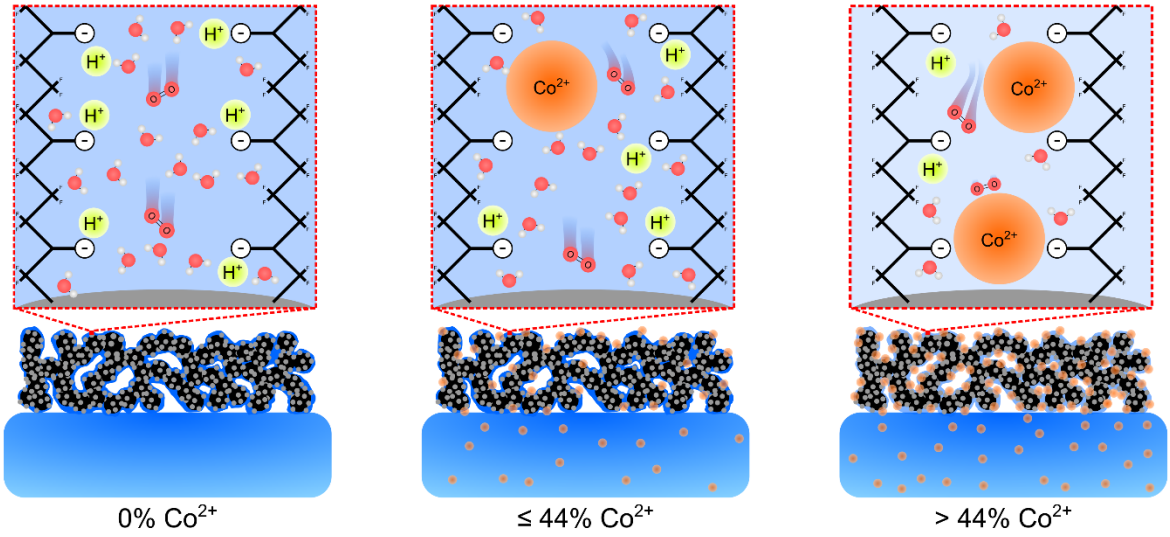

Figure 1: Water uptake and proton conductivity decreases with increasing cation contamination within PFSA ionomer films, which leads to poor PEMFC performance.