

Functionalized cathode catalysts for PEM fuel cells

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The fundamental reaction occurring in a polymer electrolyte membrane fuel cell (PEM FC) is the oxygen reduction reaction (ORR), where water is produced via chemical reaction by combining hydrogen and oxygen. In order to improve the catalytic activity of the platinum based catalyst toward the ORR, the polymer polyaniline (PANI) is added to the system in an oxidative polymerization reaction, resulting in a catalyst named Pt/C@PANI.

The prepared catalysts were electrochemically characterized ex-situ via rotating disk electrode technique using a standard three electrode set-up. In order to determine the electrochemical active surface area (ECSA) of the catalysts and the mass activity (MA), cyclic voltammetry and ORR measurements were performed in N₂ and O₂ saturated electrolyte, respectively. Regarding the results, the ECSA increased slightly in the case of Pt/C@PANI compared to pure Pt/C. The MA of Pt/C@PANI is more than two times higher than that of the uncoated catalyst [1].

In summary, the electrically conductive PANI forms a film around the catalyst particles, thus electrons necessary for the ORR are able to travel easier through the electron system of platinum, carbon and PANI. Combining these intermolecular interactions results in a very active, stable and more efficient catalyst for the ORR in fuel cells.

[1] K. Kocher, H. Hacker, Design of polymer coated catalysts for the oxygen reduction reaction toward durable PEM fuel cells, 15th Minisymposium Verfahrenstechnik and 6th Partikelforum, Montanuniversität Leoben, 2019, p. 98, ISBN: 978-3-200-06348-8