

RESEARCH PROJECT

Development of a PACVD method relevant for production to deposit electrically conducting a-C:H:N protective coatings with high rate for PEM fuel cells

The research project „HiRaCarbon“ (high rate carbon) is based on the results of the previous project „BlackBip“. In this previous project hydrogenated amorphous carbon coatings have been doped by nitrogen (so-called a-C:H:N coatings) and deposited onto metallic bipolar plates for PEM fuel cells. In the following project HiRaCarbon, the deposition time for a-C:H:N coatings on stainless steel bipolar plates will be significantly reduced. The characterization with electron microscopes and X-ray diffractometry will develop a detailed understanding of the growth of these coatings. Accompanying work will be executed to increase the reliability of the quality assurance of the necessary electrochemical corrosion measurements.

The approach followed will use two different PACVD methods and, for the first time, N-containing precursors. Both the previous RF-PACVD method and an advanced microwave PACVD method will be used, optimized and compared with each other. Especially the heating and cooling phases as well as the plasma cleaning process should be shortened. The deposition rate of the a-C:H:N coatings will be significantly increased (by a factor of 4–6). The thickness of the already developed protective a-C:H:N coating will be further reduced in compliance with the DOE criteria regarding corrosion current density and the contact resistance. The alternative “first deposition, then forming” will likewise be tested and evaluated. To raise the reliability and the sample output, the measuring cells for the electrochemical corrosion measurements will be equipped with at least two reference electrodes as well as corresponding electronics for monitoring. SMEs will profit from the project results working in the fields like energy technology, materials etc.

The benefit for SMEs comes from the improvement of the fuel cell components with respect to mobile applications, the raising of the corrosion stability of the metallic materials and the deposition of modified carbon coatings from the gas phase.

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