SILVER NANOPARTICLES ON MESOPOROUS CARBON SUPPORTS AS ELECTROCATALYSTS FOR OXYGEN REDUCTION REACTION

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40 wt% Ag catalysts were prepared onto two mesoporous catalyst supports (MC) and for comparison on conventional Vulcan carbon (VC). Ag nanoparticles were deposited onto these supports using two different wet chemical methods to compare their electrocatalytic activity. One reducing agent was $NaBH_4$ and the other was hydrazine hydrate [1]. Scanning electron microscopy showed that Ag nanoparticles were uniformly dispersed all over substrates. According to the X-ray diffraction measurements the average Ag crystallite size remained between 19 and 28 nm. X-ray photoelectron spectroscopy confirmed that the mesoporous support contained N species. To evaluate catalysts activity toward the oxygen reduction reaction (ORR) and its electrochemical stability in alkaline media, rotating disc electrode and on-line scanning flow cell coupled with inductively coupled plasma mass spectrometry methods were used [1,2]. Four-electron ORR pathway was observed for all catalysts. The Tafel slope values remained between -94 mV and -107 mV. The most active Ag/MC catalyst showed relatively increased mass activity (MA) for ORR (38 A g^{-1}) compared to the most active Ag/VC catalyst (10 A g^{-1}) at -0.2 V vs SCE. In addition to higher MA, the same Ag/MC catalyst was more stable, and Ag dissolved less during the ORR process than Ag/VC catalyst synthesised using the same reducing agent. A maximum power density of 310 mW cm^{-2} was achieved with one of the Ag/MC catalysts in an anion exchange membrane fuel cell at 65 % RH at 65 °C using H_2 and O_2 gases, which is one of the best fuel cell performance reported for Ag-based cathodes [3].

References:

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