Heteroatom doped carbon prepared by pyrolysis of bio-derived amino acid as highly active catalysts for oxygen electro-reduction reaction

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Heteroatom (nitrogen and sulfur) doped carbons were synthesized via pyrolysis of composites composed of iron chloride, cobalt chloride and five different amino acids (Alanine, Cysteine, Glycine, Niacine and Valine), and compared electrocatalytic activity towards oxygen reduction reaction (ORR) with each other for fuel cell application. All of prepared catalysts, carbons, were doped by nitrogen, and in particular, a catalyst synthesized from Cysteine was dual-doped by nitrogen and sulfur. Among all the catalysts, the dual-doped carbon showed the highest onset potential (0.55 V, vs Ag/AgCl), and electrochemical activity in acidic media, - 0.2 mA (at 0.2 V, vs Ag/AgCl) which was about 43 % of that of commercial Pt/C (40 wt%). XPS revealed that sulfur was doped in carbon as sulfate or sulfonate forms and it is surmised that not only doping of nitrogen into carbon but that of sulfur also play a key role for improving electrocatalytic activity towards ORR.