

Enhancements Electrochemical Performance of N and O Atomic Co-doped Carbon Electrodes for Vanadium Redox Flow Battery.

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Abstract: We studied effects of nitrogen and oxygen atomic co-functionalization of graphite felt (GF) by ammoxidation reactions for the electrode of vanadium redox flow battery (VRFB). Ammoxidative surface reactions of the pristine-GF with NH_3/O_2 results in effective N and O co-doping dominantly with kinetically relevant N and O functional groups; pyridinic-N, pyrrolic-N, and hydroxyl with high site densities. The N and O co-functionalization gives rise to greater reaction kinetics for both half-cell reactions than the conventional electrodes doped only with O functional groups (O-GF). The high electrocatalytic properties of N-GF afford greater voltage and energy efficiencies in VRFB than the O-GF electrode at high current density (110 mA cm^{-2}) with high charge/discharge capability owing to the significantly reduced overpotential. These results suggest the contributions of N and O co-functionalization of carbon electrode for facilitation of vanadium redox kinetics and the high effectiveness of the simple and scalable ammoxidation-based functionalization protocol.

Keywords: Carbon electrode; Surface functionalization; Ammoxidation treatment; Nitrogen doping; Oxygen doping; Vanadium redox flow battery