

**Abstract:**

An intermittent microwave heating (IMH) assisted method has been used to synthesize palladium and iron on nanocrystalline tungsten carbide (denoted as PdFe-WC/C) as a cathodic electrocatalyst for oxygen reduction reactions (ORRs). The materials are characterized by X-ray diffraction (XRD) and transmission electron microscopy (TEM) and electrochemical techniques. The ORR activity of the PdFe-WC/C electrocatalyst in acidic solution is found to be comparable to that of Pt/C electrocatalysts. It is believed that the high catalytic activity as a Pt-free electrocatalyst originates from the synergistic effect between Pd and Fe and WC. The alcohol-tolerance and selectivity of the PdFe-WC/C electrocatalyst are favorable for the ORR in the presence of alcohol which makes it a promising cathodic electrocatalyst in direct alcohol fuel cells (DAFCs). The ORR is hardly affected in the alcohol-containing solutions up to 1.0 mol L<sup>-1</sup> alcohol. The results also revealed that the ORR on the PdFe-WC/C electrocatalyst is a four-electron process. This novel PdFe-WC/C electrocatalyst could be a Pt-free alternative for a cathodic electrocatalyst for ORRs.