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Worm-like PtP Nanocrystals Supported on $NiCo_2P_x$/C Composites for Enhanced Methanol Electrooxidation Performance

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ABSTRACT: Worm-like PtP nanocrystals supported on $NiCo_2P_x$/carbon black ($NiCo_2P_x$/C) composites were prepared by a combined hydrothermal, low temperature phosphidation and $NaBH_4$ reduction process. Noteworthily, the presence and content of phosphorus (P) play a critical role in constructing one-dimensional (1D) PtP nanostructures. Electrochemical tests demonstrate that the obtained PtP-$NiCo_2P_x$/C hybrid exhibits an extremely high mass activity of 1361 mA mg^{-1}_{Pt} for methanol electrooxidation in acidic medium, which is 3.5- and 7.6-fold greater than those of commercial Pt/C (393 mA mg^{-1}_{Pt}) and home-made Pt/C catalyst (180 mA mg^{-1}_{Pt}), respectively. Meanwhile, the catalytic performence of PtP-$NiCo_2P_x$/C is also better than those of the PtP-CoP/C and PtP-Ni_2P/C catalysts due to the synergistic effect of Co and Ni. Furthermore, PtP-$NiCo_2P_x$/C catalyst exhibited better durability and CO tolerance compared with other catalysts in this study. The enhanced catalytic performence of PtP-$NiCo_2P_x$/C hybrid can be attributed to the special 1D morphology of PtP nanocrystals, the strong interaction between catalytic species and support, as well as the existence of metal center ($M^{\delta+}$, M = Ni or Co) and $P^{\delta-}$ active sites for the

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