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Deciphering the Structure and Electroactivity of La_2CuO_4/Printex L6 Composites for CO_2RR

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The electrochemical conversion of carbon dioxide (CO_2) into valuable products offers a promising alternative to mitigate climate change and decrease environmental impacts [1]. CO_2 electroreduction (CO_2RR) is recognized as a clean and efficient strategy [2]. In this study, novel nanostructured electrocatalysts based on La_2CuO_4 and Printex L6 carbon black were developed for use in CO_2RR. The sol-gel synthesis involved steps at 80 °C and 180 °C, followed by calcination at 800 °C in an oxidizing atmosphere. Structural and surface characterizations included SEM, Raman, BET, XRD, XPS, and EIS. The electrocatalytic performance of the electrocatalysts was evaluated using a rotating ring-disk electrode (RRDE). La_2CuO_4 exhibited a lamellar morphology, while the La_2CuO_4/Printex L6 composite (1:1 w/w) showed spherical Printex L6 particles anchored on the oxide plates. XDR diffractograms displayed peaks corresponding to the orthorhombic phase of La_2CuO_4. Hydrodynamic voltammetry in 0.1 mol L^{-1} $KHCO_3$ saturated with CO_2 at 1600 rpm indicated an earlier onset potential (E_{onset}) for the composite (-0.78 V vs. RHE) compared to Printex L6 (-1.05 V) and La_2CuO_4 (-1.02 V). The RRDE system enabled real-time detection of the generated products: the composite initiated carbon monoxide formation at -0.8 V and formic acid at -0.85 V vs. RHE. Signs were detected on the ring at 0.85 V and 1.26 V vs. RHE, respectively. The RRDE technique proved advantageous over traditional methods like GC and LC by decreasing the time between product generation and detection.

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