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Local and Non-local Functions of Cs Promoter in the O₂-Oxidation of Graphite

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The O₂ oxidation reaction of graphite was studied in the presence of two different types of Cs promoters: Cs adsorbed on surface [Cs(ad)] and Cs trapped beneath a surface carbon plane [Cs(tr)]. The techniques of reactive ion scattering (RIS) and scanning tunneling microscopy (STM) found that reaction of O₂ with Cs(ad)/graphite produces CsO and CsO₂ intermediates on the surface. In the presence of Cs(tr), O₂ molecules chemisorbs directly at the carbon plane above Cs(tr). The CsO and CsO₂ precursors react off only a few surface carbons at high temperature, whereas the chemisorbed O₂ molecules remove 10³ surface carbons. The result demonstrates the long-range promotion of the reaction by electron-transfer from Cs(tr) to graphite, in contrast to the localized promotion by direct Cs(ad)-oxygen interactions.