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Review

Carbon Dioxide Reduction with Homogenous Early Transition Metal Complexes: Opportunities and Challenges for Developing CO₂ Catalysis

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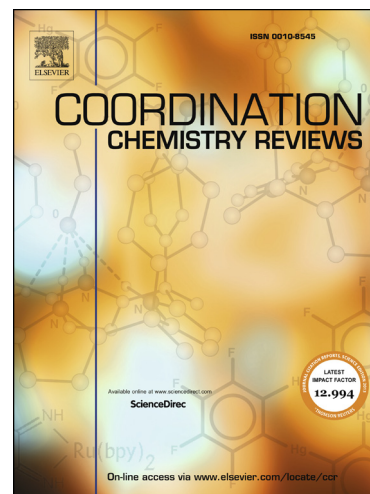
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1 **Carbon Dioxide Reduction with Homogenous Early Transition Metal Complexes:**
2 **Opportunities and Challenges for Developing CO₂ Catalysis**

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9 **Abstract**

10 The field of carbon dioxide reduction by homogeneous early transition complexes
11 (groups 3–7) is reviewed. Many reactions with CO₂ have been studied with late transition metal
12 complexes (groups 8–10), and significant progress has been made in developing active and
13 selective homogeneous catalysts for CO₂ reduction with late metals. However, one major
14 drawback of these systems is that they generally only produce the 2e⁻ reduction products CO or
15 formate. In comparison, early transition metal complexes have been comparatively neglected for
16 the development of CO₂ reduction catalysts. However, stoichiometric and catalytic reductions of
17 CO₂ to methanol and similar products have been observed with early transition metal complexes,
18 and highly active catalysts may be developed based on early transition metal complexes that
19 could reduce CO₂ to liquid fuels such as methanol or to hydrocarbons such as methane.

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