# Electrochemical Reduction of Iron Oxide - Produced from Iron Combustion - for the Valorization of Iron Fuel Cycle

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## Electrochemical Reduction of Iron Oxide - Produced from Iron Combustion - for the Valorization of Iron Fuel Cycle

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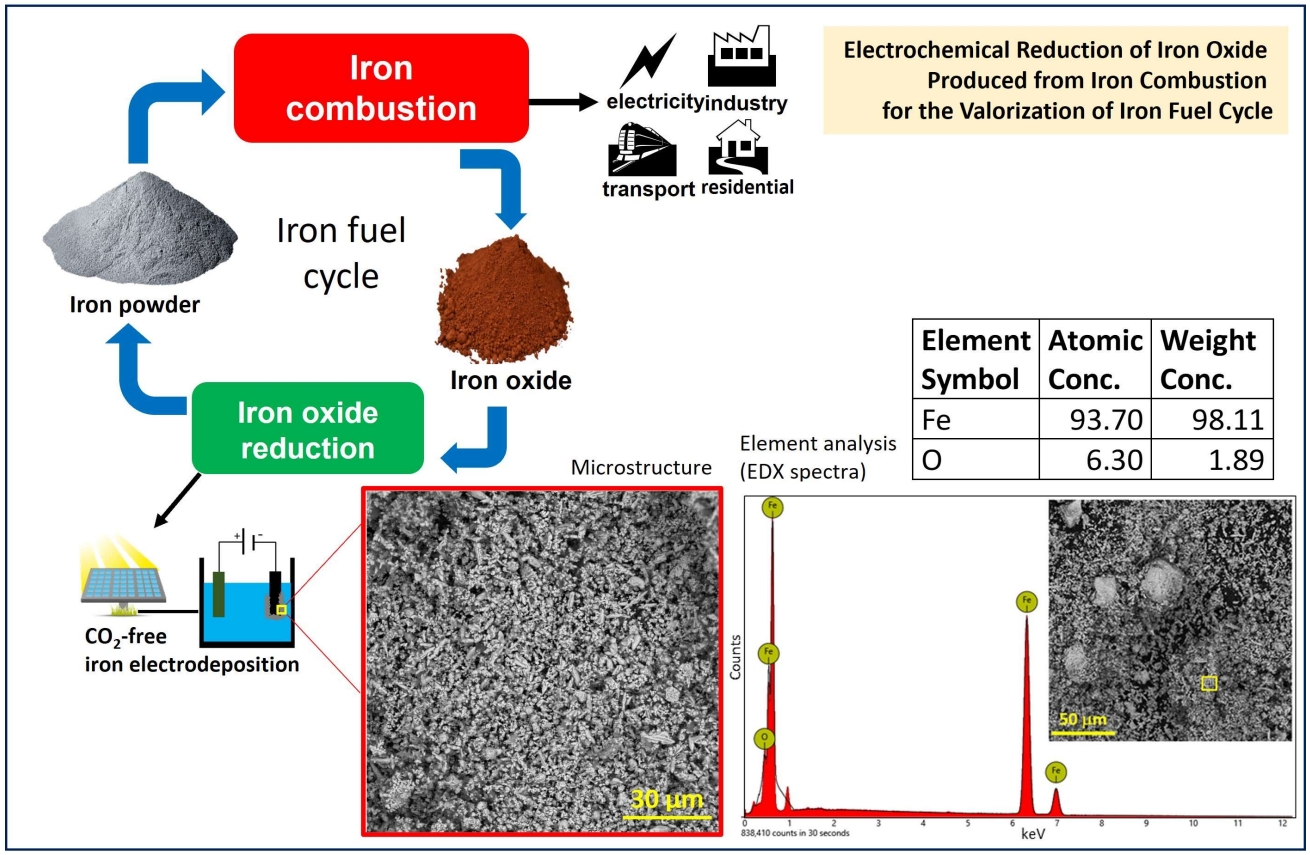
**Abstract Text:**

Iron is a prospective candidate for energy carriers in the energy transition era with high energy density. In this concept, energy is released by the combustion of iron powder whilst the solid product - iron oxide - can be collected and reduced back to metallic iron, forming a recyclable iron fuel cycle. The electrochemical technique is considered to be a suitable reduction method as it has attractive aspects including low electric energy consumption, low temperature, direct usage of renewable energy, and a short process chain. In this study, the performance of iron electrodeposition is investigated using an electrolysis cell containing a suspension of micron-sized combusted iron powder in aqueous NaOH (50%wt, 18 M) at a temperature of 110°C. The parallel plate electrolyzer used in these experiments consists of a stainless-steel plate (cathode) and a nickel gauze (anode). The effects imposed by varying current density, iron oxide composition, and iron oxide particle diameter on Faradaic efficiency and reduced iron yield are evaluated. Additional experiments using a rotating disc electrode (RDE) are also conducted to determine the system's diffusion coefficient under different operating conditions. Generally, cathodic deposition of metallic iron is successfully achieved and the morphology of the deposited iron depends on the operation conditions including the current density and heterogeneity of the flow system. The obtained results open new perspectives for efficient and cost-effective iron production/regeneration.




| Element Symbol | Atomic Conc. | Weight Conc. |
|---|---|---|
| Fe | 93.70 | 98.11 |
| O | 6.30 | 1.89 |

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Oral

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