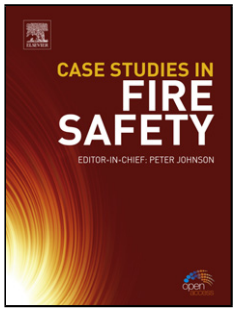

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Electrochemical Studies of Molten Sulfates in LiCl-KCl-Na_2SO_4 at 700 °C

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Highlights:

- SO_4^{2-} is electrochemically reduced to S and S^{2-}, only at large overpotentials.
- SO_4^{2-} reduction reaction is irreversible with slow charge transfer kinetics.
- Oxidizing O_2-SO_2 atmosphere drastically shifts OCP in the positive direction.
- Gas atmosphere and thermal stability affect reduction reactions in molten sulfates.

ABSTRACT

The electrochemical reduction behavior of molten Na_2SO_4 was investigated at 700 °C in LiCl-KCl-Na_2SO_4 (5−15 mol%) electrolyte under two different gaseous atmospheres of inert argon and oxidizing O_2-0.1% SO_2. Sulfate ions (SO_4^{2-}) were directly reduced into sulfur (S) and sulfide (S^{2-}) ions at large negative overpotentials in both gaseous atmospheres. During the transition from inert to oxidizing atmosphere, open circuit potentials of a platinum electrode (vs. Ag/Ag^+) were shifted in the positive direction by more than 0.60 V, implying the presence of stronger oxidants which can be coupled with the metal oxidation reactions during the hot corrosion processes.