

**Effect of sulfate and carbonate ions on reinforcing steel corrosion as evaluated using
AC impedance spectroscopy**

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Abstract: The electrochemical behavior of carbon steel in saturated calcium hydroxide solutions has been studied using AC impedance spectroscopy and linear polarization resistance techniques. Sulfate and carbonate ions help to break down the protective passive films, resulting in an increased rate of corrosion. The behavior of the sulfate is different from that of CO₂ since the sulfate forms a less protective film than the original iron oxide film. The CO₂, however, has two effects. It modifies the Ca(OH)₂ solution with the formation of CaCO₃ and also modifies the original passive film, leading to increased corrosion rates. With an increase in temperature from 22 to 50 C, the corrosion rate may be increased by as much as a factor of about 20. Two-time constants initially characterize the electrochemical reactions caused by both sulfate and carbonate ions, but these reactions are eventually controlled by charge transfer.