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Mg^{2+} ions reduce the electrical double layer forces between carbonate particles

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Carbonates are the most widespread minerals in the world which dominate sediments and sedimentary rocks in the Earth's crust [1,2].

Their nucleation, growth, and transformation in aqueous solutions are linked to the properties of the electrical double layer surface.

Understanding of carbonate formation, stability, and dynamics remain a challenge due to many possible and often concurrent transformation pathways [3].

Experimental insight into the significance of the electrical double layer forces in complex solutions (with adsorbing ions) during the carbonate nucleation process are limited [4].

Our work shows how the properties of the electrical double layer formed at the carbonate/electrolyte interface are changing in time.

Specifically, we examine the evolution of the zeta-potential using electrophoresis and surface potential using potentiometric measurements.

The presence of Mg^{2+} ions stabilizes metastable carbonate phases, but at the same time, destabilizes particle suspensions by reducing repulsive EDL forces.

Our results show that the role of the additives on carbonate nucleation pathways is more complex than previously anticipated. In particular, the complex interplay between the EDL properties and carbonate particle structure/morphology can be responsible for a number of phenomena, including chemical compaction processes in the carbonate sediments.

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