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The Impact of Anisotropic Reaction Rates on Dissolution Dynamics

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Mineral dissolution processes are prevalent in nature, yet the effects of anisotropic reaction rates, stemming from factors such as mineralogy and thermal gradients, still remain poorly understood. In this work, we leverage a level-set immersed boundary method to study reactive transport for a grain with heterogeneous reaction rates. Specifically, we analyze the major axis orientation, mass center displacement and eccentricity of the grain geometry during dissolution in the parameter space of Peclet number, Damköhler number and anisotropy factor. Our findings include a phase diagram that illustrates the transition between anisotropic and non-anisotropic effects. The results advance our understanding of the interplay between flow dynamics, reaction rates and anisotropy, thereby offering new insights into reactive transport.

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References

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