A Study on Ammonium Chloride Dendrite Tip Kinetics: The Importance of the Solid–Liquid Density Change and Interfacial Kinetics	
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Abstract: Ammonium chloride (NH4Cl) has been extensively studied as a transparent analogue for investigating the solidification of metals due to its distinctive properties and the simplicity of the experimentation. Furthermore, NH4Cl exhibits a striking resemblance in solidification behavior to the majority of binary eutectic alloy systems, rendering it a valuable model for studying phase transition phenomena. Experiments conducted on ammonium chloride are frequently employed to validate numerical models for predicting grain structures, macrosegregation, and the columnar-to-equiaxed transition (CET). This latter phenomenon arises due to differences in the velocities of columnar dendrite tips and the liquidus isosurface. However, the kinetics of dendrite tip growth, as a function of supersaturation, remains poorly understood for this commonly used alloy. The objective of this study was to utilize the available experimental data in conjunction with Ivantsov correlations to shed light on the ambiguous kinetics. The results indicate that when considering the crystal–melt density ratio, the Ivantsov solution offers a good correlation. Furthermore, incorporating a moderate interfacial kinetic coefficient enhances the correlations further. This correlation can be implemented in numerical models, which will aid in the determination of the columnar front, the columnar-to-equiaxed transition, and the equiaxed growth velocities.