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Direct and indirect influence of crystallization on double-diffusive convection in ammonium-chloride solutions DAISUKE NOTO, Hokkaido University, STEN ANDERS, SVEN ECKERT, Helmholtz-Zentrum Dresden-Rossendorf, YUJI TASAKA, Hokkaido University — Crystallization inside fluid flow is a complicated, but highly fascinating phenomenon in the field of geo- or astrophysics. For instance, a magnetic field of Jupiter's moon Ganymede is thought to be sustained by crystallizing flow termed iron-snow, but little is known up to date. Thus, experimental tests to seek likely conditions for a presence of a dynamo are required. We have approached these phenomena via a model experiment using a test fluid of aqueous ammonium-chloride solution, which changes phase from liquid to solid under room temperature. To quantify velocity and temperature fields simultaneously, thermochromic liquid crystals (TLC) were suspended into the test fluid. We have established a masking technique to obtain velocity fields of the continuous and the solid phase. In addition, a neural network based thermometry utilizing TLC coloration has been established. With these methods, we found a direct and indirect influence of the crystals on the flow. At the beginning of the cooling process, intense precipitation of equiaxed crystals can directly modify the flow structure. Meanwhile, columnar crystals start to grow, and impede the cooling from the wall. Indirectly, crystal growth creates a stable density stratification, but an unstable temperature stratification.

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