Recent research works have been focused on the numerical simulation of solidification in ingots; however, accurate experimental data which indicate the solidification phenomena are still needed for validation of simulation and for further study of combined fluid flow and complex solidification. A physical model using a transparent material system has been built to simulate the solidification of steel. NH$_4$Cl solution as transparent analog was filled into a rectangular “mould”. Various solidification phenomena such as columnar and equiaxed growth, CET (Columnar to Equiaxed Transition), sedimentation of the equiaxed grains have been observed and quantitatively analyzed. The solution temperature at different position inside the mould has also been measured during “solidification”. A series of experiments have been performed with different cooling and heating conditions or “hot-top” application in order to study how the solidification system responds to the parameter variation.

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