Phase-field : Recent advances on phase-field models and simulations
7-9 Jan 2020 Pessac (France)

Microscopic infrared thermography experiments and Phase-field simulations to study the solid-liquid interface crystal growth kinetics in undercooled melts

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Abstract: The advanced method we propose allows *in-situ* experimental analysis by microscopic thermal imaging techniques. Contrary to experimental techniques based on optical microscopy or video cameras, microscopic infrared thermography provides detailed analysis of the interface temperature. It is essential when discussing the temperature dependence of experimentally determined growth rates. The used microscope also allows reaching high resolutions and obtaining new information on crystal morphologies. An innovative numerical data treatment has also been developed to process the infrared images allowing the estimation of the properties of the solid-liquid interface over the phase transition (such as anisotropy, curvature, kinetic coefficient) which are poorly known and difficult to measure. The appropriateness of microscopic infrared thermography for crystal growth kinetics analysis is illustrated through the experimental analysis of erythritol. Our *in-situ* experimental method allows tracking its solid-liquid interface over phase transition and Phase-Field allows modeling its behavior whatever the bulk temperature. This method could thus lead to deepen our understanding of the mechanisms of formation and evolution of complex microstructures.

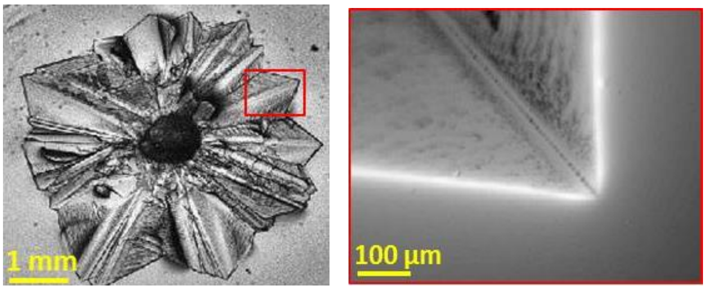

Figure. Erythritol solid-liquid phase transition at T=110°C (undercooling degree of 11°C)

Keywords: *Solid-liquid interface, phase transition, undercooling degree, microscopic infrared thermography, Phase-field simulations.*

Acknowledgements: The research leading to these results is carried out in the frame of SUDOKET project, co-funded by the Interreg Sudoe Program through the European Regional Development Fund (ERDF). The authors acknowledge them as well as the financial support of Region Nouvelle Aquitaine for subsidizing BioMCP project (Project-2017-1R10209-13023). We also would like to thank CNRS for promoting the I2M Bordeaux - CICe exchanges in the framework of the PICS PHASE-IR project.