

# Solidification and Melting - Asymmetries and Consequences

*M. Rettenmayr*

Friedrich-Schiller-University Jena

## **ABSTRACT**

Solidification and melting are both processes that involve a liquid and a solid phase. As compared to solidification, research work on melting documented in the literature is relatively scarce. This is certainly due to the fact that solidification is of higher interest for technical applications, as the properties of a cast material are directly connected to the microstructure evolution during solidification. However, (local) melting can have a drastic effect on microstructure evolution in quite a few technical processes - neglecting melting will then lead to drastically erroneous results.

At first glance it is tempting to adapt know-how from the further developed solidification theory to melting, as melting and solidification could be expected to be similar. It appears to be straightforward to treat these phase transformations symmetrically, i.e. melting as the inverse process of solidification. However, it is a long known experimental fact that upon cooling of liquid metals an under cooling under the equilibrium melting temperature can hardly be avoided, but that upon heating solid metals can only be heated above their melting temperature while remaining in the solid state with considerable experimental effort. In the present contribution, further differences between solidification and melting that are documented in the literature and the results of melting experiments will be presented that show the consequences of the asymmetry.