



The ICAMS Seminar presents

Dr. Nils Warnken

Department of Metallurgy and Materials,
University of Birmingham

Monday, 9th of November, 4 p.m.
ICAMS Seminar room UHW 11/1102

Phase field simulation of microstructure evolution in Superalloys

Superalloys are a class of metallic alloy developed over the last decades specifically for high temperature applications. Ni-based single crystal superalloys form a subgroup which are used for turbine blades and vanes in the hottest section of gas turbines. Based on Nickel, these alloys contain significant amounts of approximately ten alloying elements. In order to obtain the best high temperature properties these alloys are directionally solidified and subsequently heat treated. Heat treatment cycles of modern single crystal superalloys take up to three days at temperatures around 1330°C.

The work presented here aims at deriving a modelling approach for the microstructure evolution in directionally solidified single crystal superalloys and the subsequent solution heat treatment. The modelling approach comprises phase-field simulations coupled to calculation of phase equilibria and diffusion data via the CALPHAD method.

Microstructure simulations for the whole geometry of a turbine blade are still not possible, even on today's supercomputers. Therefore an isothermal section approach is introduced to bridge the length scales between the thermal field and the microstructure.

The results of the solidification and solution heat treatment simulations are compared with experimental results.