Investigations on peritectic solidification of a binary organic system

In order to study the dynamics of peritectic solidification a binary nf/nf organic system with a peritectic point has been optically investigated. The appearance of different solid state plastic and non-plastic phases is discussed in the light of recently published phase diagram information.

Figure 1 shows the phase diagram of the both organic substance A and B. In the dark green area both substance are optically active. In the light green area one of the substance only one of the organic substance are optically active and the other one not. In the white area non of the phases are optically active. The left picture shows the border between the optically active phase and the optically inactive phase on the left side. The picture was take with polarized light and so the optically phase is dark. The right picture shows the left border between the optically active phase and the non optically one. Here is the light unpolarized and the optically inactive phase is bright.

In the presented work rectangular samples (30mm x 20mm x 150 µm) have been filled with different transparent model alloy compositions. Subsequently the samples have been transferred on to a horizontal micro bridgman furnace (T_{hot}~150°C; T_{cold}~30°C) in a ZEISS microscope in transmitted light mode and videos and images have been recorded using a self-developed image processing device.

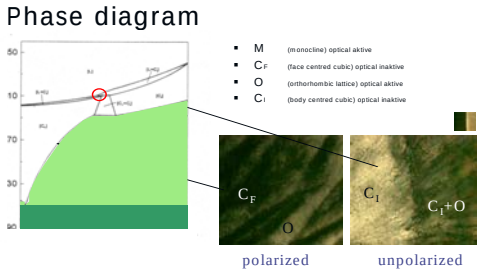

Figure 1: Phase Diagram

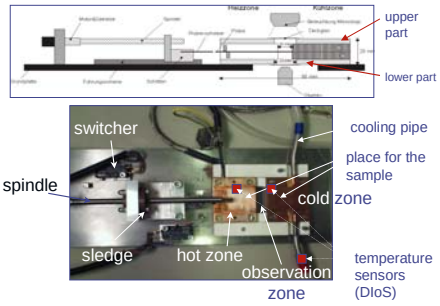

Figure 2: micro Bridgman furnace

Figure 3 shows the display of the Dios system. On the left side is the area of observation in the micro Bridgman furnace built in the Zeiss microscope.

Both organic substances show optically active and inactive phases in the phase diagram, which can be distinguished using polarity filters. This are images of various compositions taken around the solidification front in the micro bridgman oven.

On the left side are the display for the temperature sensors. It is possible to definite a start or an end temperature value for record. Above the picture are the elements to stored the pictures and/or the temperature values. It is possible to take every 1/10 seconds a picture up to hours.

The micro bridgman furnace consisted of a hot zone and a cooling zone both with two copper plates. Between the hot zone and the cooling zone is the area of observation (**figure 2**). A motor moves over a spindle the sledge with the sample through the furnace. Depending on the speed a temperature gradient is created. Pt 100 temperature sensors are in the hot zone, the observation zone and in the cooling zone The temperatures are stored in the DioS system.

This home made device, called Dynamic Imaging of Solidification (DIoS) allows simultaneous recording of images/videos and 4 temperatures via PT-100 thermo sensors.

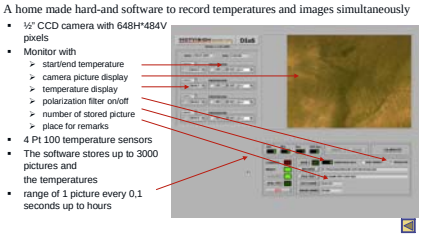

Figure 3: Dynamic Imaging of Solidification system

In **figure 4** are the points of observation and the change between the optically active phase, blue dots, and the optically inactive phase, red dots. The small grey lines characterize the calculated phase diagram with pure substance but both substance are very hydrophilic. **Figure 5** describe the same situation with pictures from the observation zone in detail. At the moment there are only unpurified substance available. In case of this the peritectic phase diagram degenerated to a eutectic phase diagram.

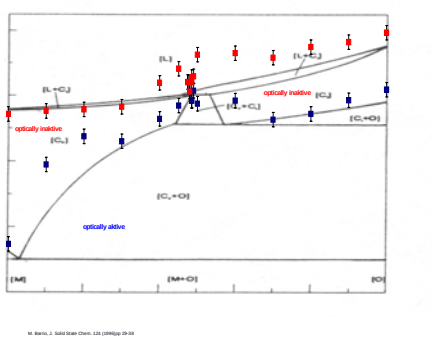

Figure 4: points of observation

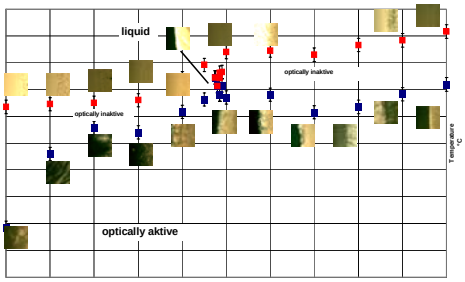

Figure 5: steady state - map

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