

# WPI High-throughput Calculation for Eutectic Alloys of Al-Mg-Zn-Cu

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## Background

Eutectic compositions in metallic solutions can be very useful in various applications, e.g. metallic glass. It is usually an easy case to find eutectic compositions in binary and some ternary systems. However, as the number of alloying elements increases, it requires a large amount of work to determine the eutectic temperatures.

In this project, equilibriums of thousands of compositions in the Al-Mg-Zn-Cu system are calculated with Thermo-Calc via TC-python. the goal is to determine eutectic points through these compositions by finding the solidus and liquidus temperatures.

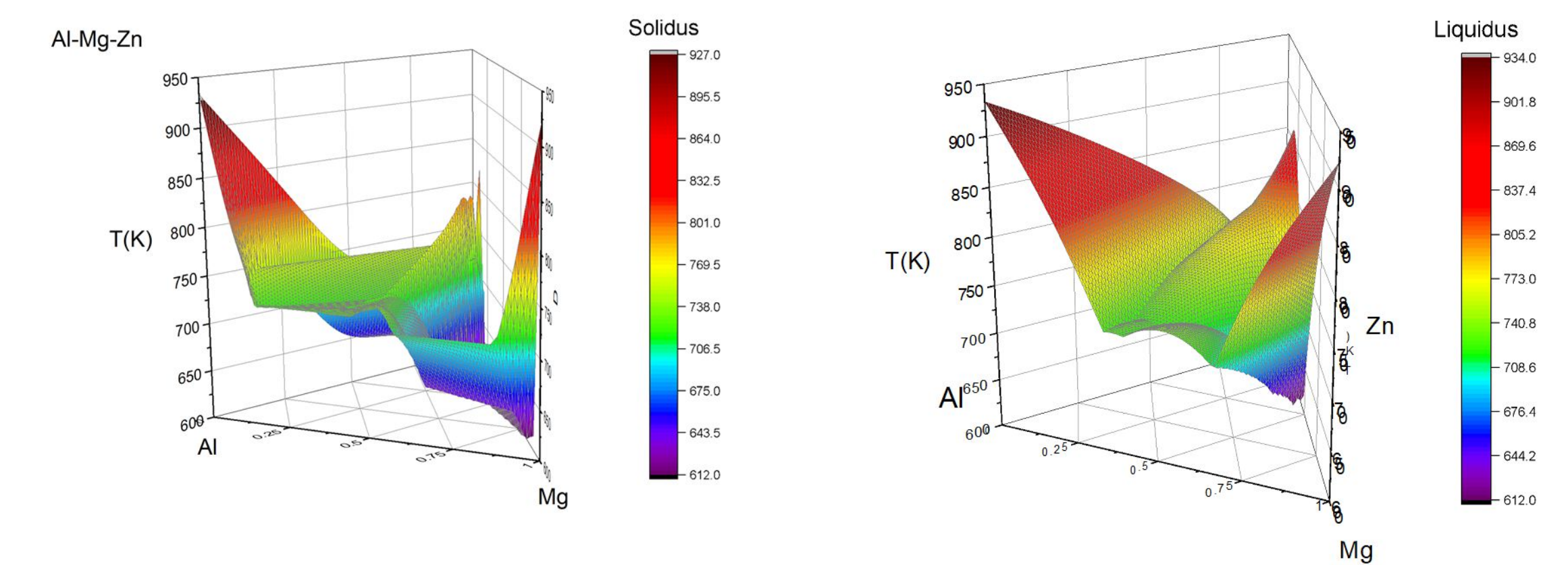
## Process

The process starts with determine the compositions for calculation. The four-element system of Al-Mg-Zn-Cu is divided into binary, ternary and quaternary compositions for purpose of calculations with thermo-calc.

For binary and ternary systems, compositions are defined at a 1 wt% step, and in total six binary and four ternary systems are defined for calculation. For quaternary system, 2 wt% step is used since there are a large number of compositions in this category.

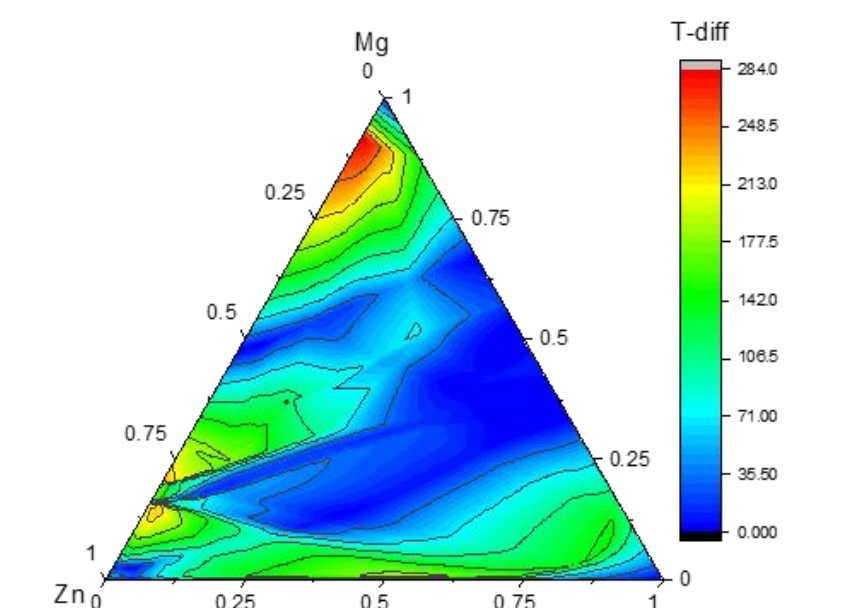
Single point equilibriums are calculated before the solidus and liquidus temperatures are determined.

## Al-Mg-Zn



The liquidus and solidus of the ternary system throughout the compositions.

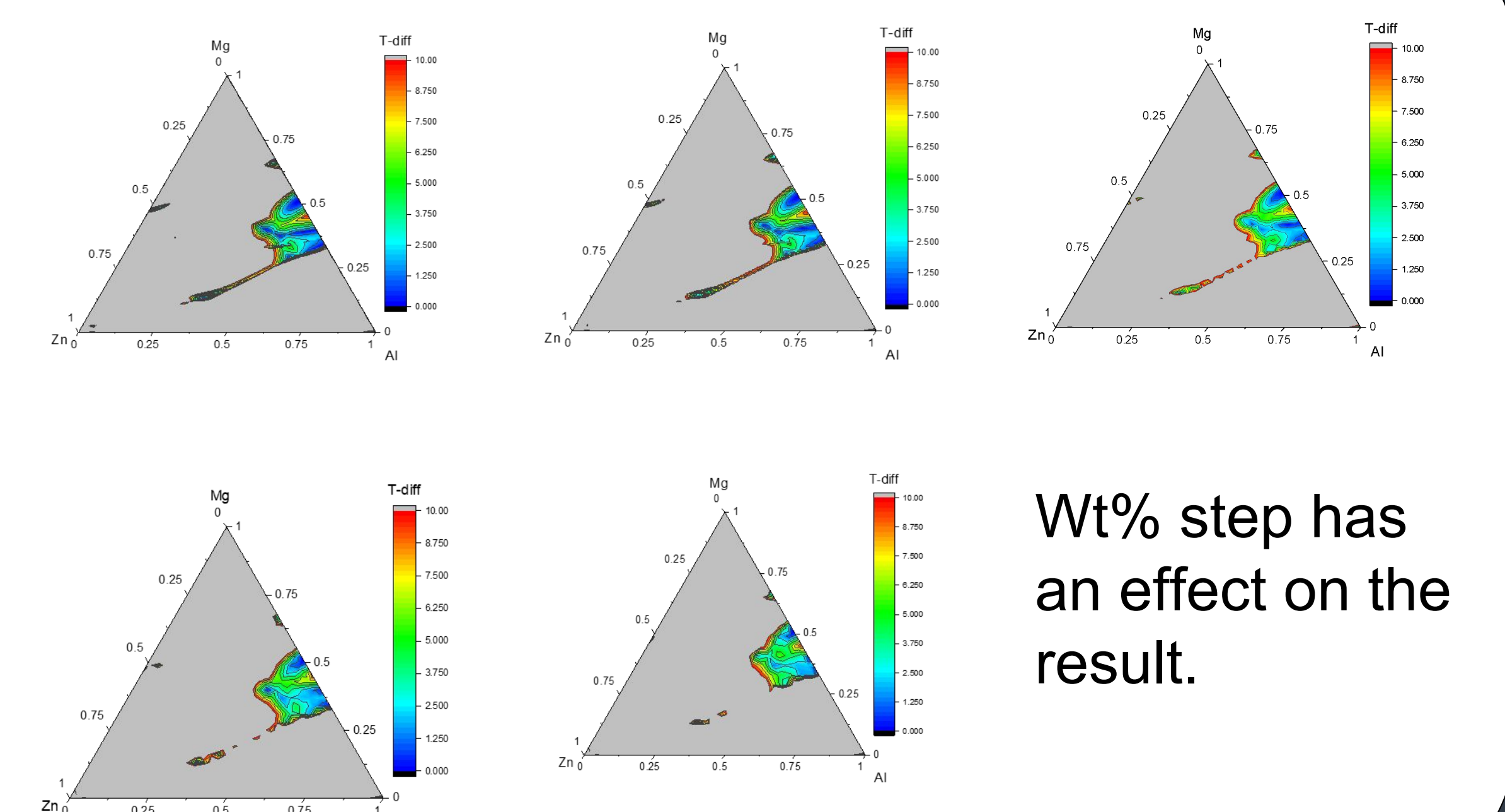
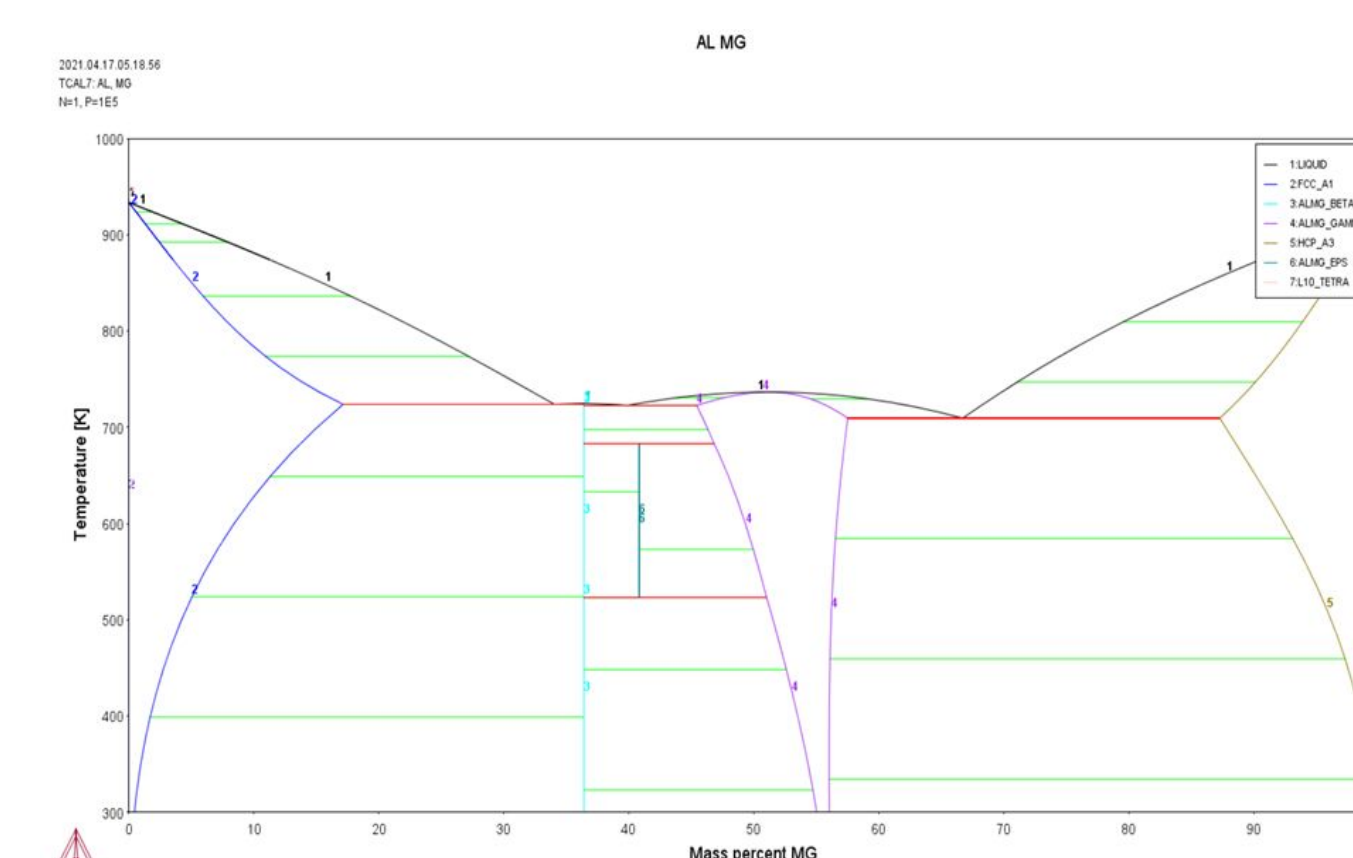
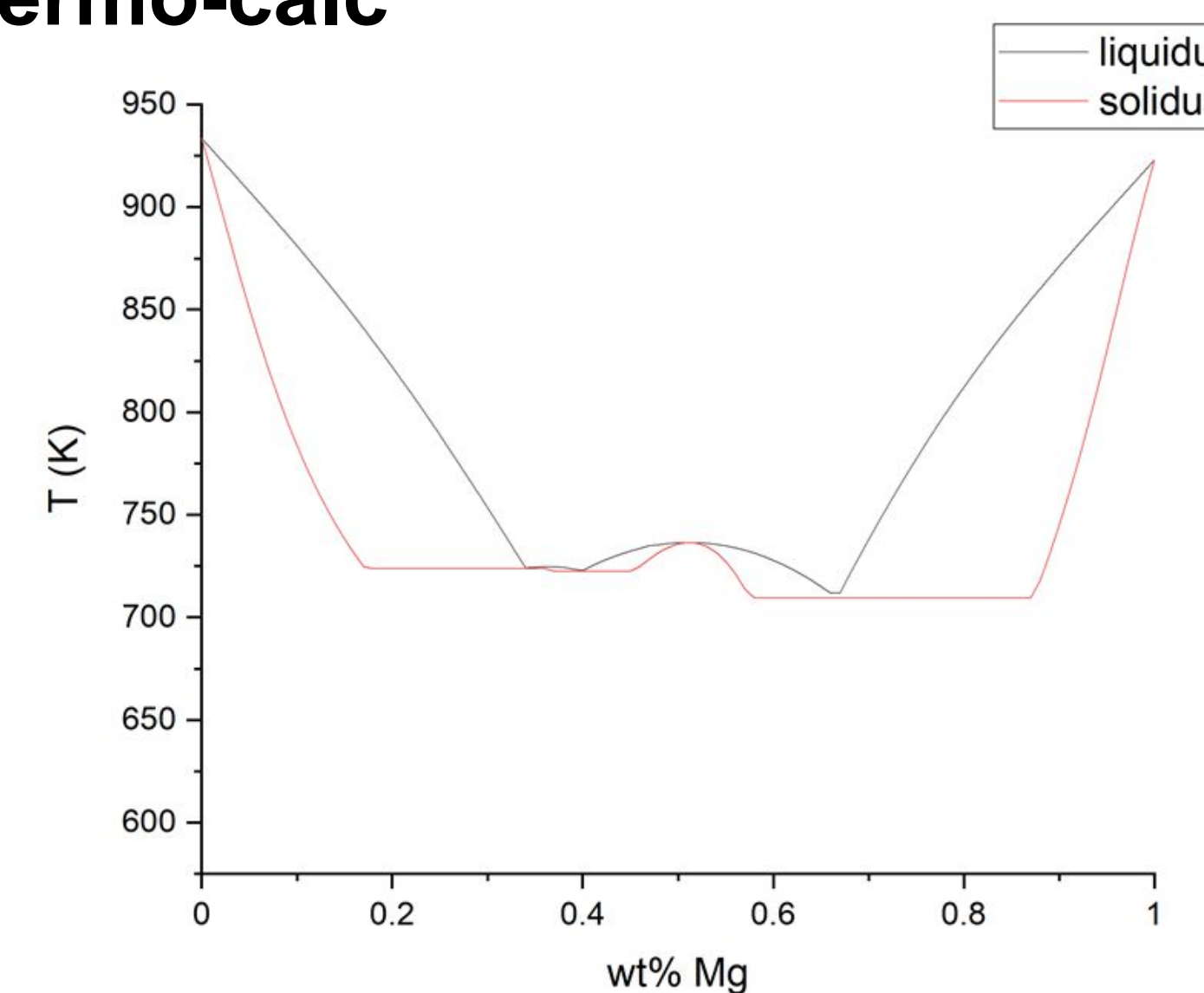
T-difference as a indicator of potential eutectic points



## Objectives

1. Define the system and compositions for calculation
2. HT calculation of binary, ternary and quaternary systems with TC-python.
3. Analyze the results on solidus and liquidus temperatures.
4. Determine the eutectic compositions in the system

## Binary Result compared to Thermo-calc



Wt% step has an effect on the result.

## Quaternary Calculation

- How to find potential eutectic compositions
- T-difference selection
- Maximums and minimums