Solidification of metals and alloys

System, components, phases.

A system is a part of the space separated for examination purposes.

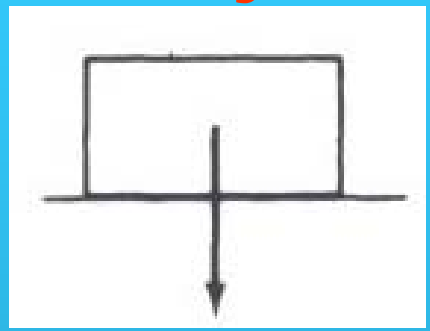
The substances forming a system are called components. An alloy system may contain any number of components.

A phase is a chemically homogeneous and physically distinct part of a system, which is separated from the other parts by an interface.

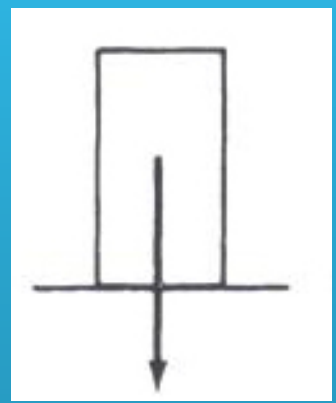
A system is in equilibrium if its free energy is minimal.

The state of the system may be

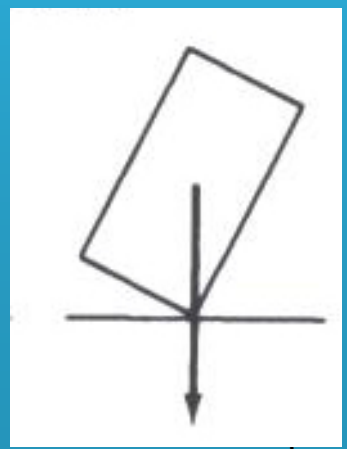
stabil (mimimal energy level)



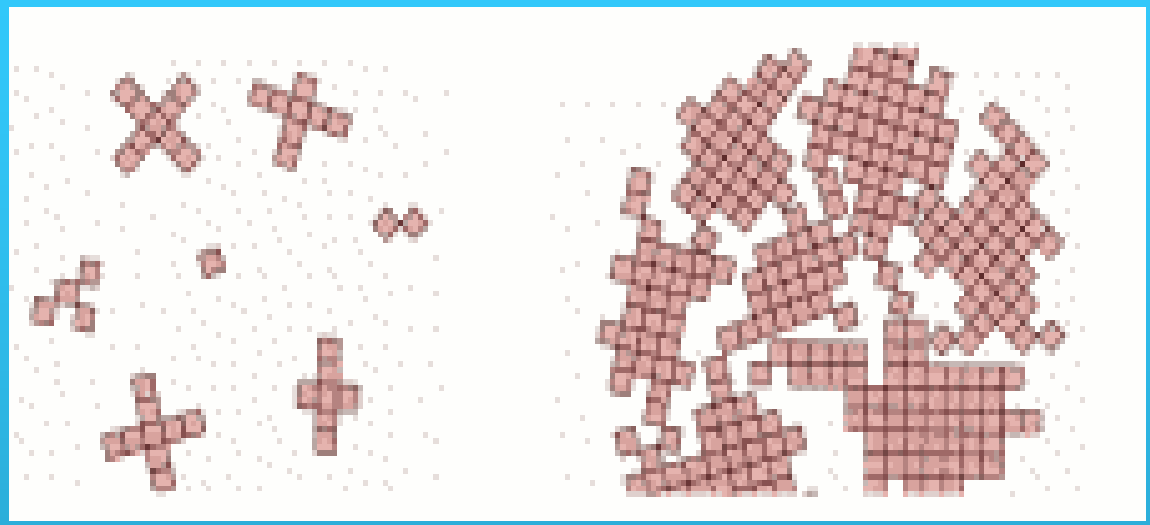
metastabil (the energy level of the phases are different from the minimal, bur they are able to stay in this state)

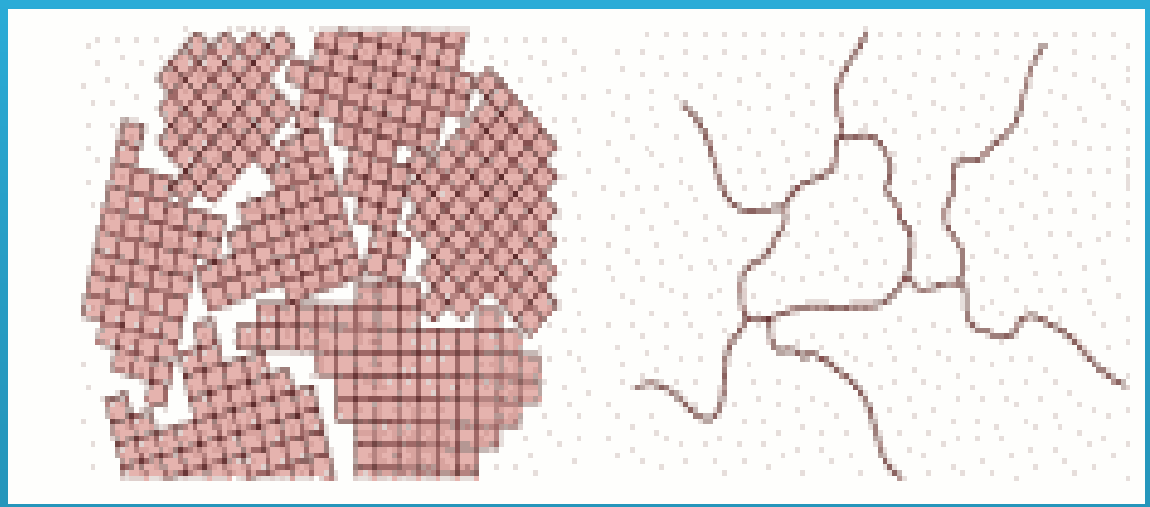


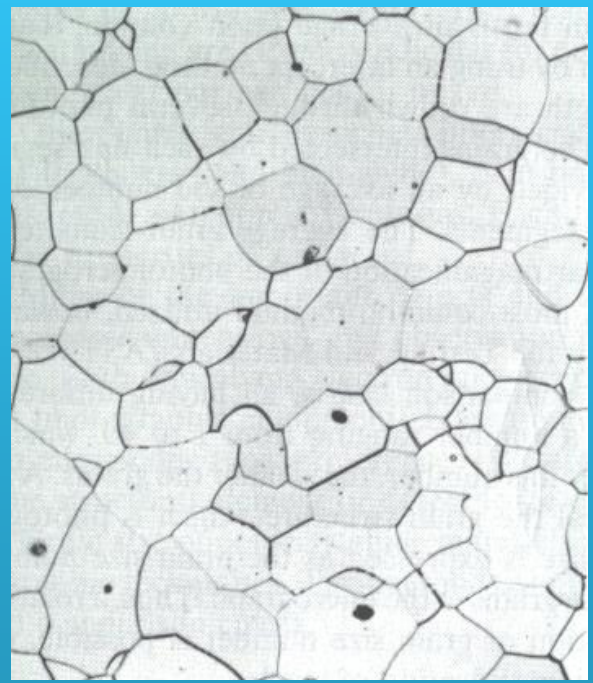
instabil



The process of solidification

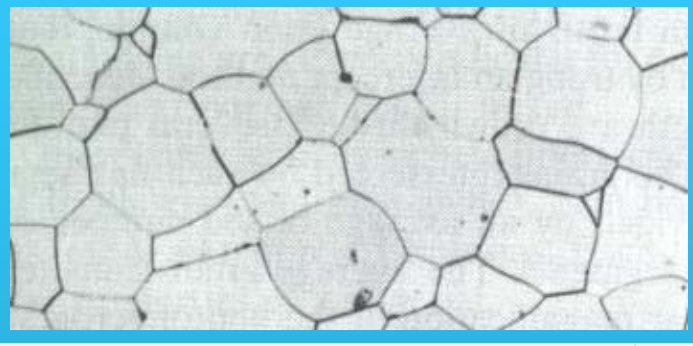




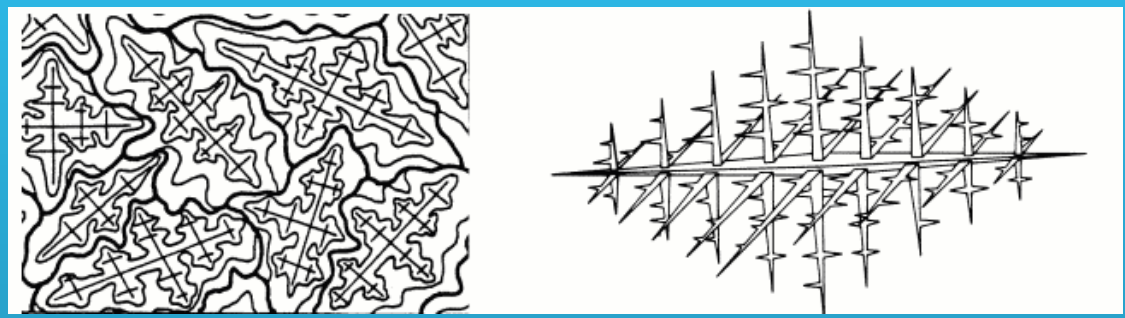


The forms of solidification

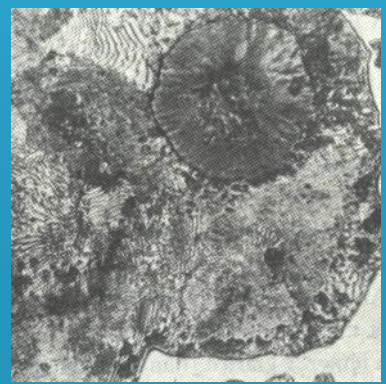
- Polyedric

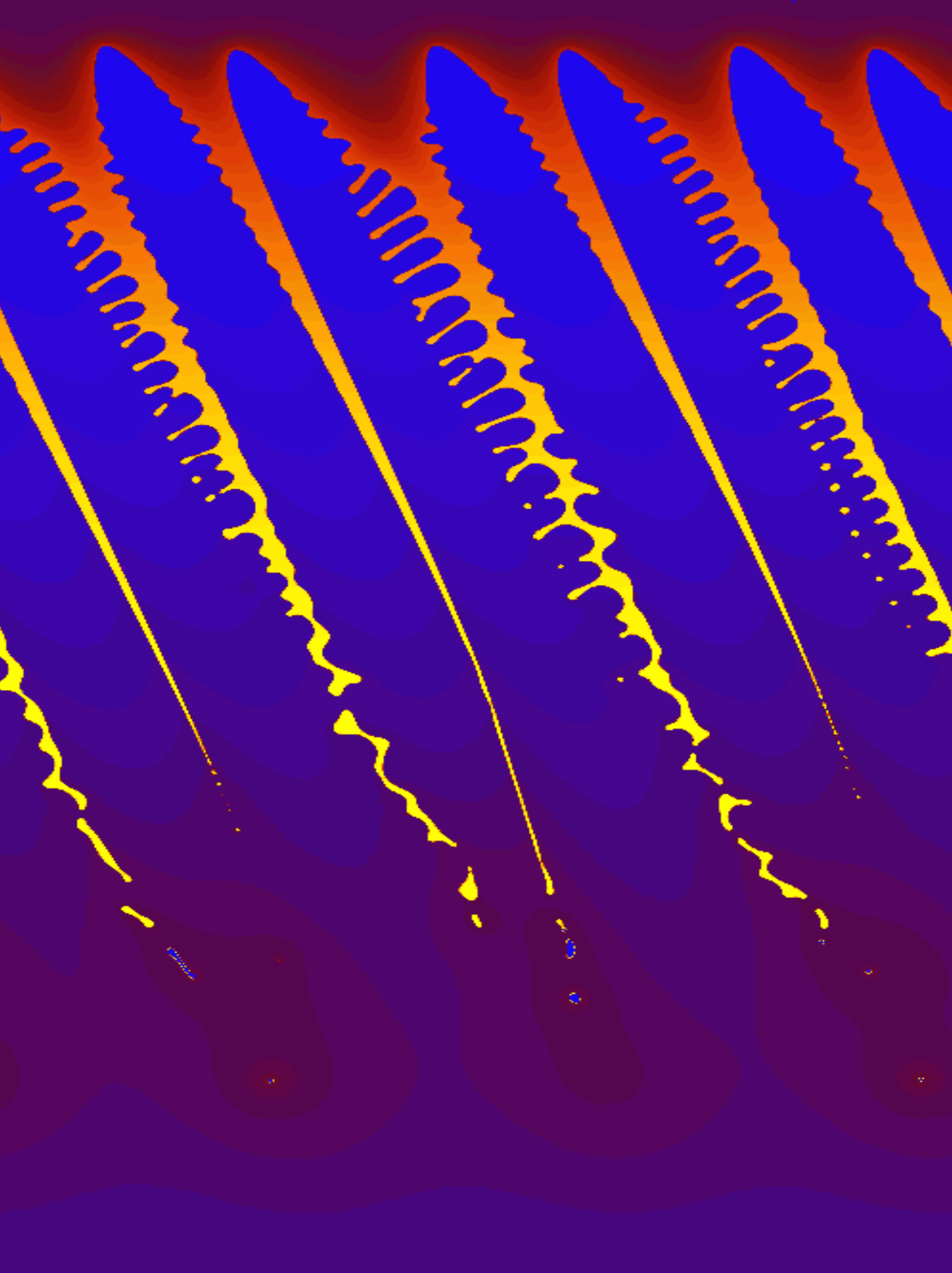


- Dendritic



- Spheroidal





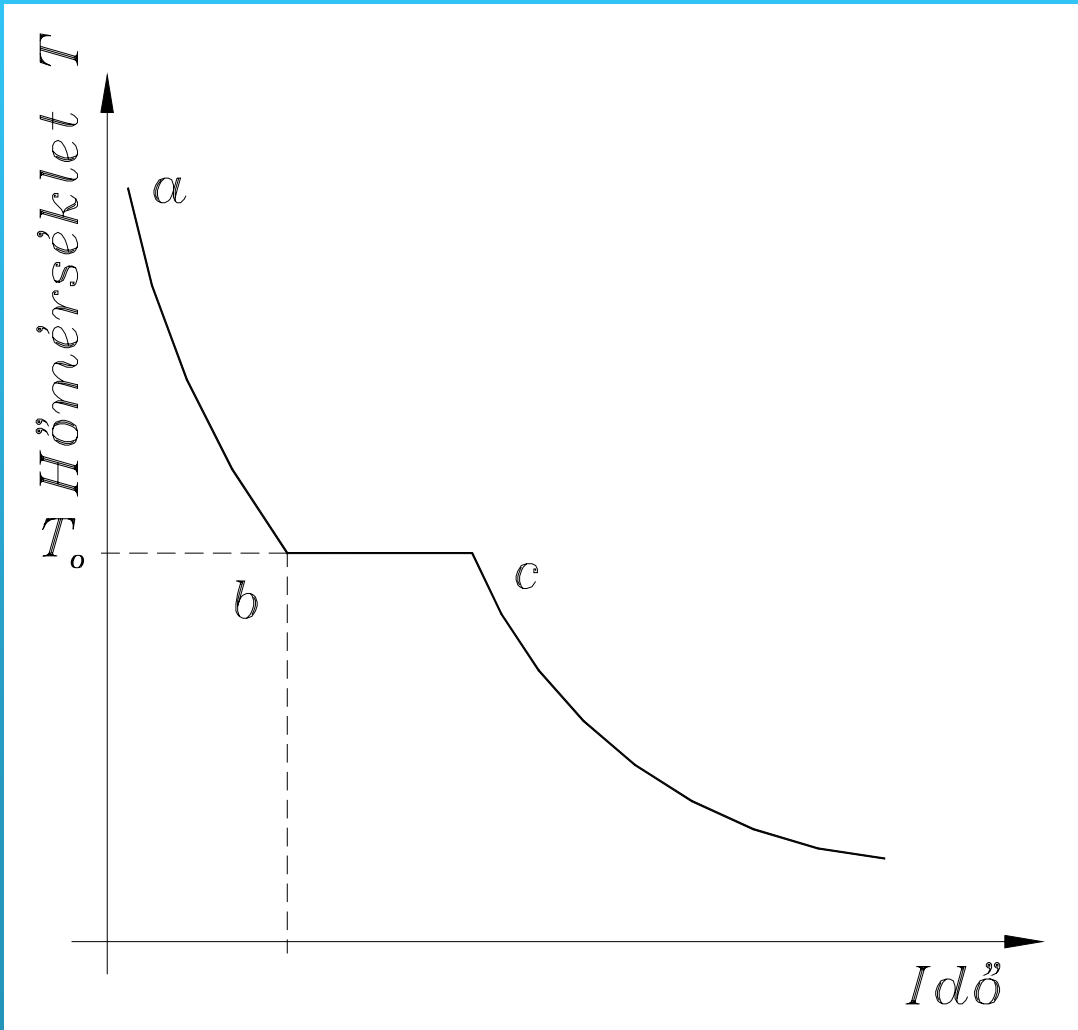
Cooling curves and equilibrium diagrams

the relationship between the composition, temperature and microstructure of alloys are illustrated by equilibrium diagrams

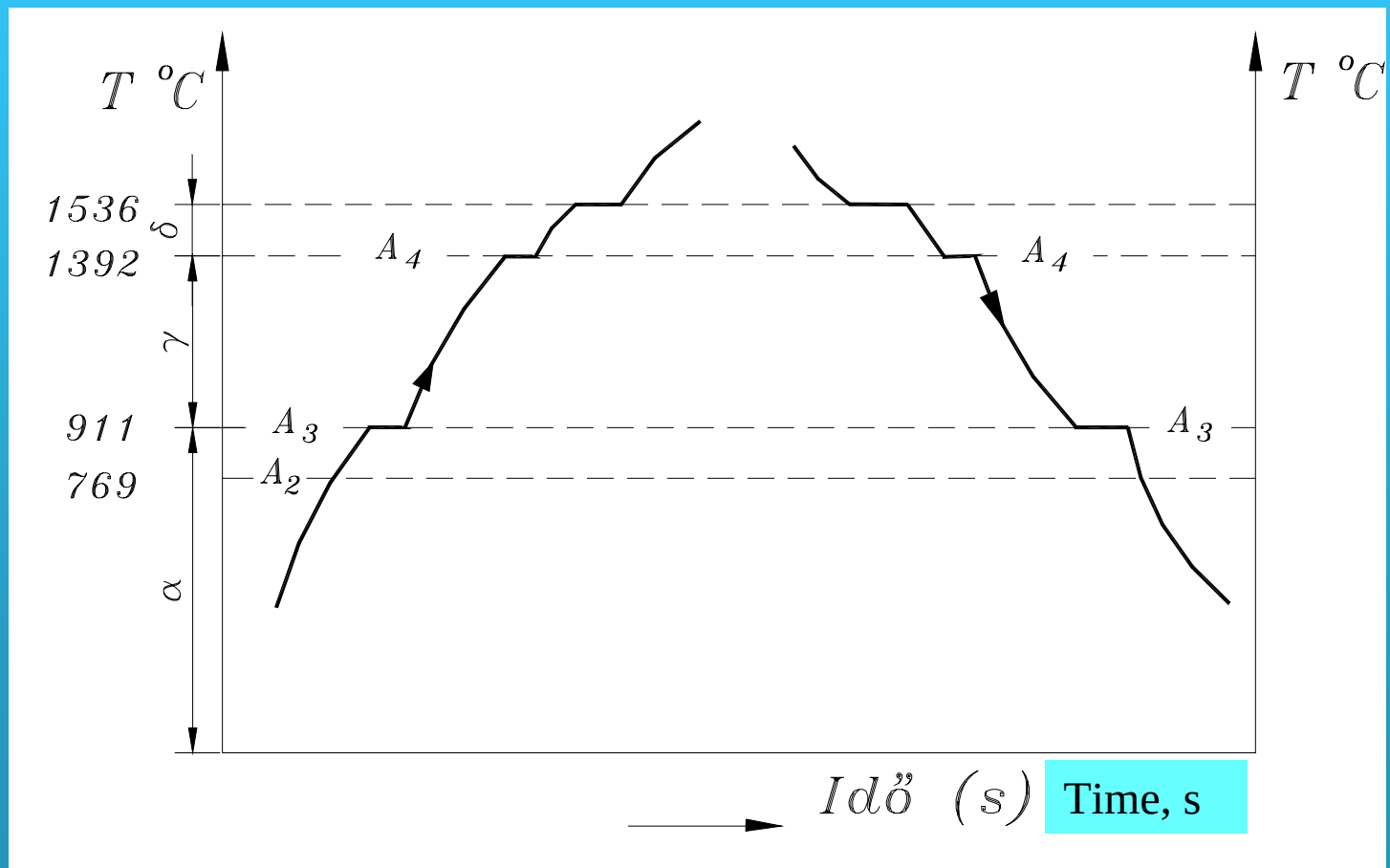
equilibrium diagrams are constructed from cooling curves

cooling curves are determined by experiment applying thermocouples

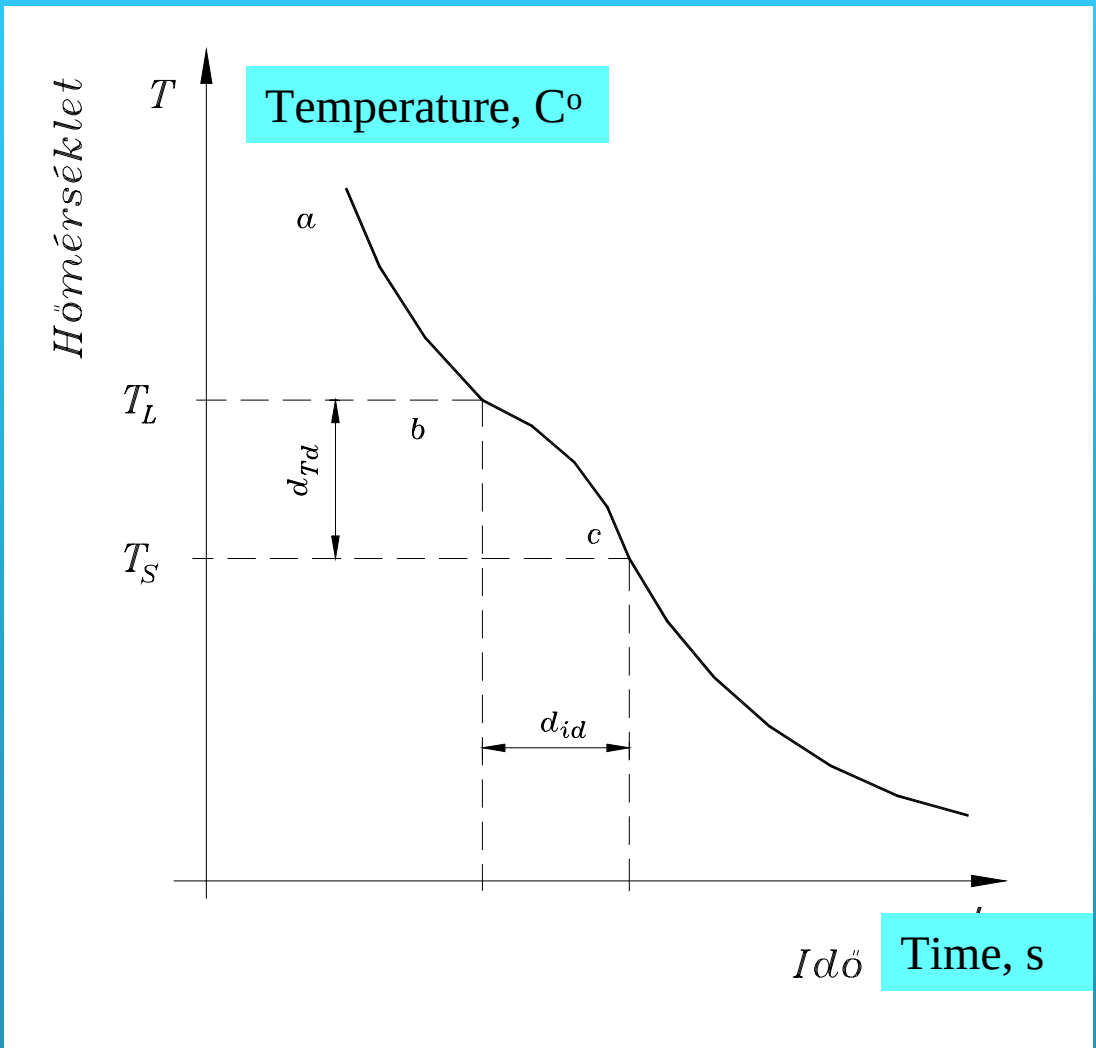
The cooling curve of pure metal or metal compound



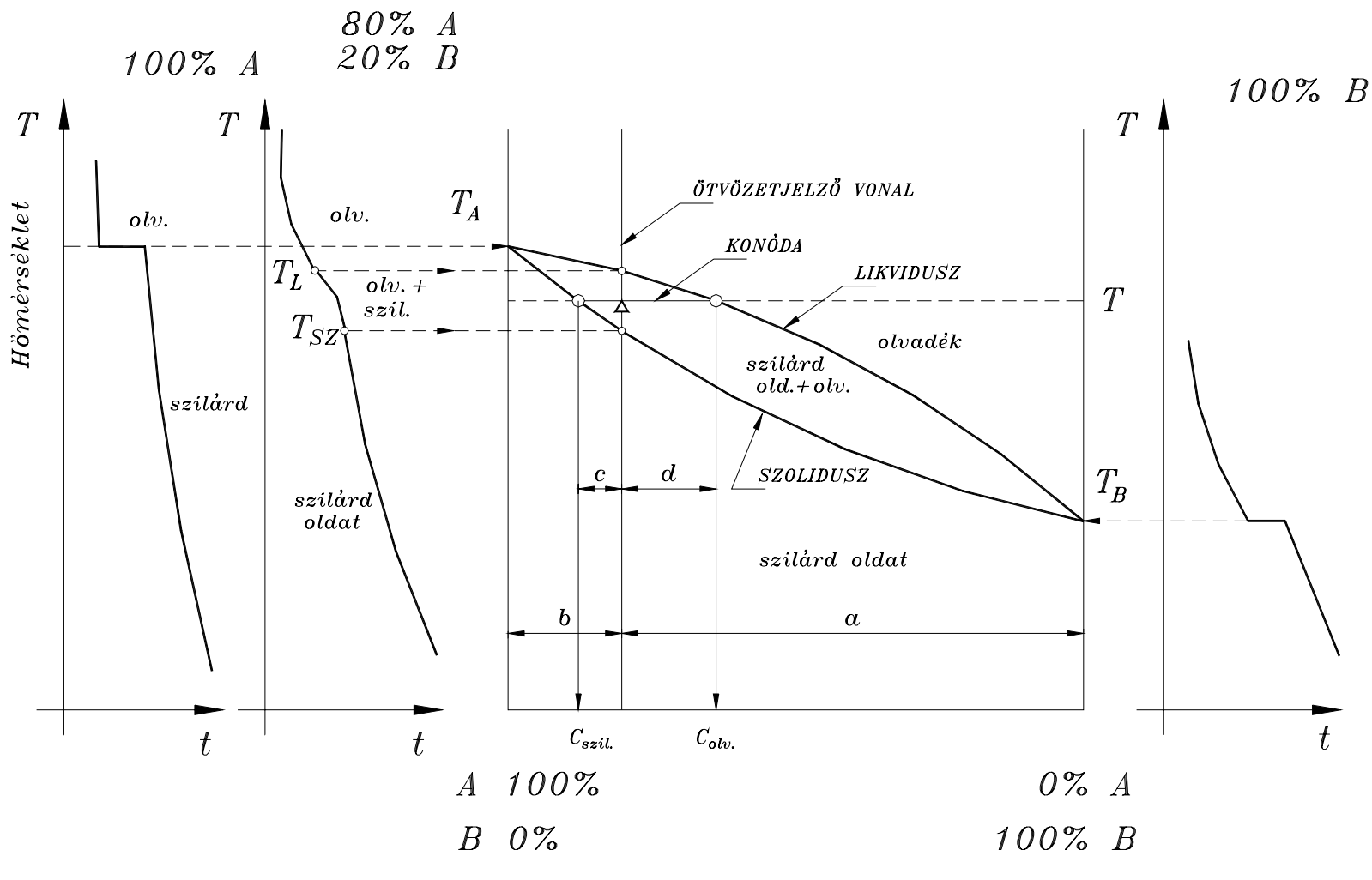
The heating and cooling curve of pure iron



The cooling curve of solid solution



The construction of equilibrium diagrams

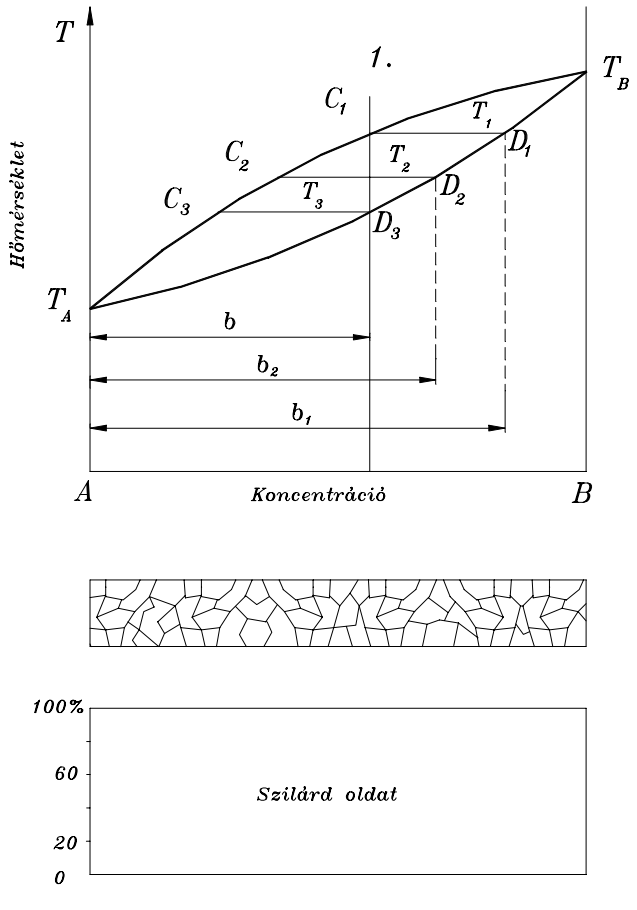


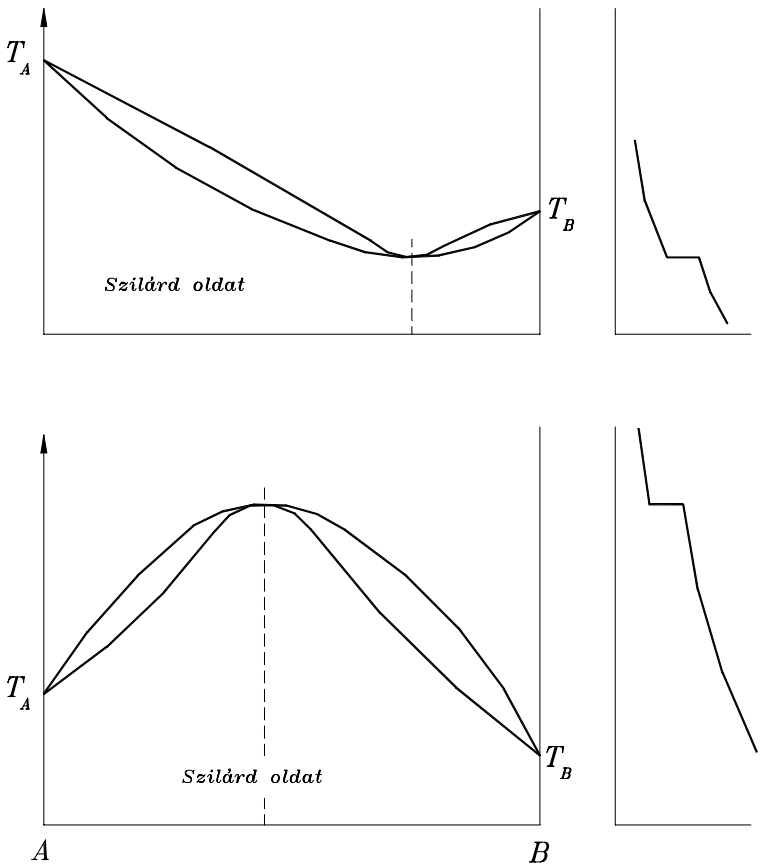
Information content of equilibrium diagrams

at a given temperature and by a given composition:

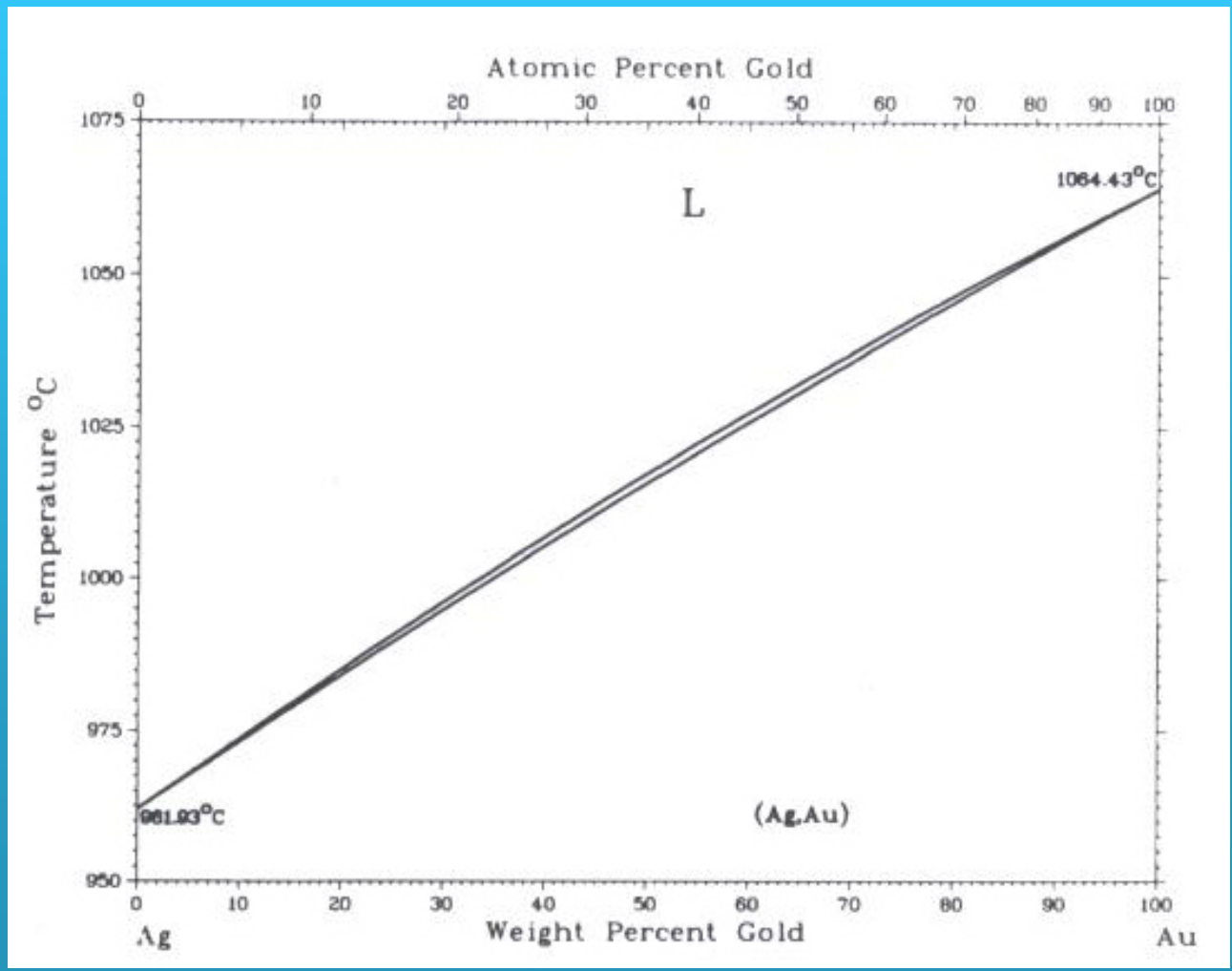
- **The number and type of phases**
- **The compsition of phases**
- **The quantity of phases**

Systems exhibiting complete solid solubility



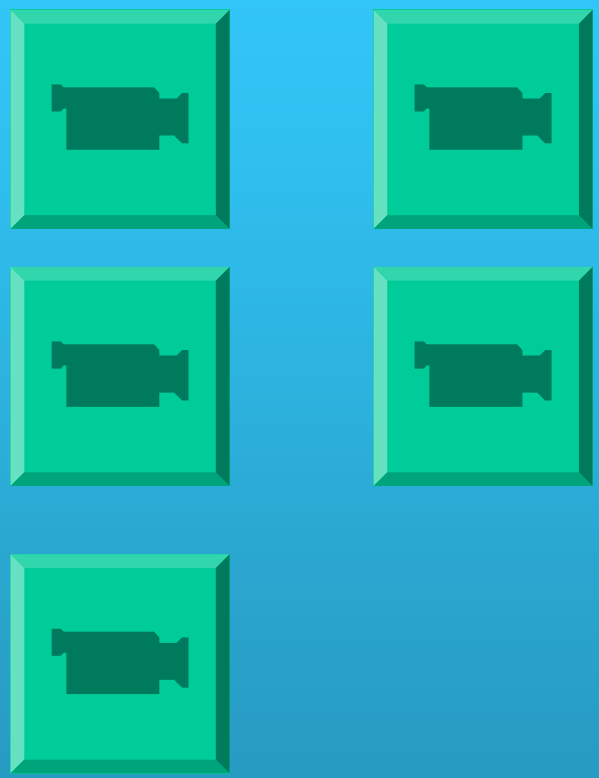


Ag-Au equilibrium diagram



Multimedia teaching materials

- Cooling process
- Lever rule
- Questions



Source: http://www-g.eng.cam.ac.uk/mmg/teaching