Phase diagrams of binary systems II

- Binary system with formation of compounds -

a) Congruently melting:

An example is the phase diagram of the two components magnesium and calcium which form a compound with the composition CaMg₂. This diagram consists of two simple eutectic systems (one of them between Mg and CaMg₂ and the other between CaMg₂ and Ca). The compound CaMg₂ by itself is represented by a vertical line. A characteristic feature of a congruent melting compound is that at the composition of this compound the liquidus curve shows a maximum. A melt with the composition CaMg₂ changes directly from liquid to solid CaMg₂ (at 720°C).

b) Incongruently melting

A compound AB melts incongruently if AB at certain temperature converts to give mixture of e.g. solid A and a liquid with another composition than AB. With further heating, A gradually dissolves as the liquid becomes A-richer. The last A crystal should disappear when the temperature reaches the liquidus curve at the given total composition. The invariant point where the three phases A, AB, and liquid coexist is called peritectic point. Peritectic point differ from the eutectic point because it isn’t a maximum on the liquidus.

Phase diagram for (H₂O, HF):

This system exhibits an exciting phase diagram where H₃O⁺, HF and F⁻ combine differently via hydrogen bridges. For H₂O×HF and H₂O×4HF we find maxima in the liquidus curve (and eutectic points between H₂O and H₂O×HF and between H₂O×4HF and HF), so they show congruent melting. H₂O×2HF shows incongruent melting at T = -78°C, there is no maximum in the phase diagram. It decomposes to solid H₂O×HF and a liquid with higher HF content.

References: