

COMPOSITION

Phase Diagrams 3

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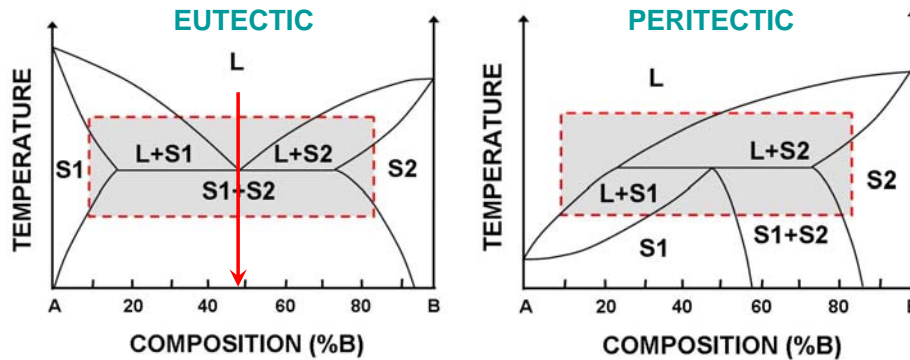
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Binary phase diagrams are classified based on the major patterns of their 2-phase regions. We have already talked about COMPLETE SOLID SOLUTIONS and EUTETICS. Now let's look at the rest of the patterns.

CLASSIFICATION

Binary phase reaction patterns.



- “Eutectic” means “low melting” in Greek.
- Major phase region patterns are described as phase reaction types.
- “ic” used for L-to-S phase patterns; “oid” used for S-to-S phase patterns.

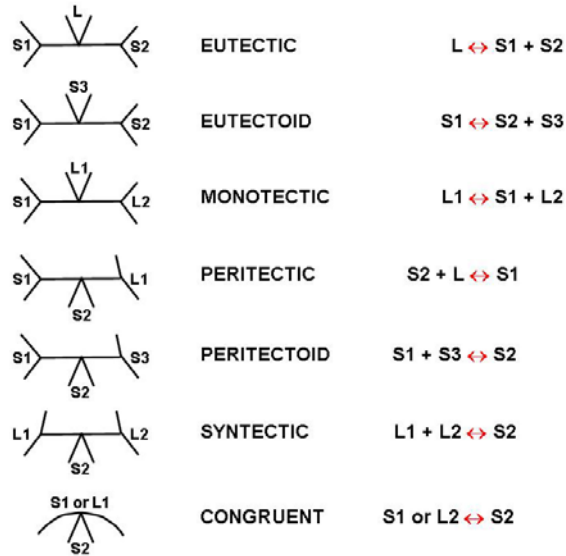


Eutectic patterns are common on phase diagrams. **[CLICK]** Eutectic means “low melting” in Greek. **[CLICK]** On the diagram shown, there is a specific eutectic composition (52A-48B) with the lowest melting transition for the alloy of A-B. If you cool down this eutectic composition, the L phase transforms into S1+S2 at a single point. This can be written as a chemical equation as $L \leftrightarrow S1+S2$. **[CLICK]** Thus we can talk about these types of diagrams in terms of characteristic PHASE REACTIONS. On these diagrams there is a single X-T point at which technically there are actually 3 phases that exist at equilibrium. **[CLICK]** If these involve liquid-to-solid transformations, then the suffix “ic” is used. If these involve solid-to-solid transformations, the suffix “oid” is used.

[CLICK] Another common phase reaction called PERITECTIC is shown. The purpose of this module is simply to expose you to these different patterns and not to make you into a phase diagram expert. The peritectic phase reaction is described as $L+S2 \leftrightarrow S1$. Now let’s look at all the major types in the next slide.

PHASE REACTIONS

All binary phase reaction patterns.

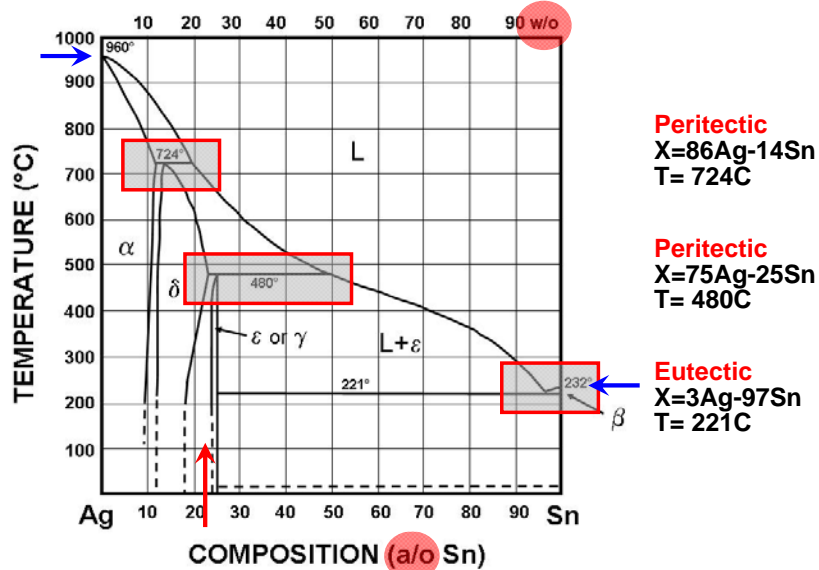


There are 7 major phase reaction types that are important at least to recognize for dentistry. You are NOT responsible for knowing them other than for the eutectic. Simply understand that these others exist.

Until this point we have dealt with relatively simple binary phase diagrams that include only one of these phase reaction types. However, you can have many on the same diagram. All the terminology and rules for using a phase diagram continue to operate in the same way. Let's see if you can now use them.

COMPLEX PHASE DIAGRAM

Multiple phase reactions on Ag-Sn binary phase diagram.



75Ag-25Sn **[CLICK]** is the principal composition mixed with Hg to create dental amalgam. **[CLICK]** Note that on this particular diagram the scale at the bottom is in atomic percent and the one at the top is in weight percent.

How many major phase reactions (or patterns) can you detect on this diagram? Take your time. There are 3. The highest temperature one is a peritectic **[CLICK]** that occurs at 724C. **[CLICK]** The second is also a peritectic that occurs at 480C. **[CLICK]** The last is a eutectic that happens at 221 C. Parts of this phase reaction are so close to the boundary for 100% Sn that they are hard to see.

What is the melting temperature for pure Ag and pure Sn? They are 990C and 232C, respectively. On this particular diagram, most of the solid phases are named with Greek letters that correspond to the crystal structure types for the phases rather than the general nomenclature of S1, S2, etc. that we have been using so far. Phase boundaries that are still uncertain are indicated with dashed rather than solid lines.

This example is much more complicated than anything else we will have to deal with in dentistry. Take a deep breath. Everything from here on will be much easier with phase diagrams.

QUICK REVIEW

Review of phase reactions on binary diagrams.

- **What is the PHASE REACTION for a eutectic?**
L \leftrightarrow S1 + S2
- **What is the SUFFIX used for solid-only phase reactions?**
"OID"
- **What is the translation of the Greek word EUTECTIC?**
LOW MELTING.
- **How many phase reactions appeared on the Ag-Sn diagram?**
3 (PERITECTIC, PERITECTIC, EUTECTIC)
- **How many PHASE REACTIONS exist on a complete solid solution phase diagram?**
0 (THERE IS NO UNIQUE 3 PHASE POINT ON THAT DIAGRAM.).



Here is a quick review of the concepts from this module.

[CLICK] (1)What is the PHASE REACTION for a eutectic?

[CLICK]

[CLICK] (2) What is the SUFFIX for solid-only phase reactions?

[CLICK]

[CLICK] (3) What is the translation of the Greek word EUTECTIC?

[CLICK]

[CLICK] (4) How many phase reactions appeared on the Ag-Sn diagram?

[CLICK]

[CLICK] (5) How many PHASE REACTIONS exist on a complete solid solution phase diagram?

[CLICK]



THANK YOU



THANK YOU.