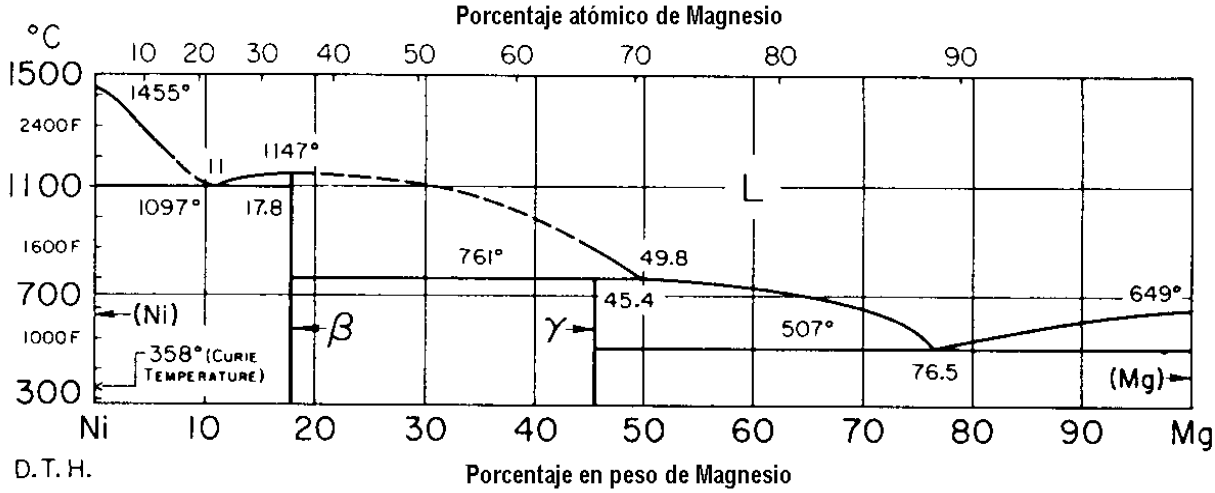
Subject: MATERIALS
Degree: GRADO en INGENIERÍA MECÁNICA. 2nd Grade

PHASE DIAGRAMS

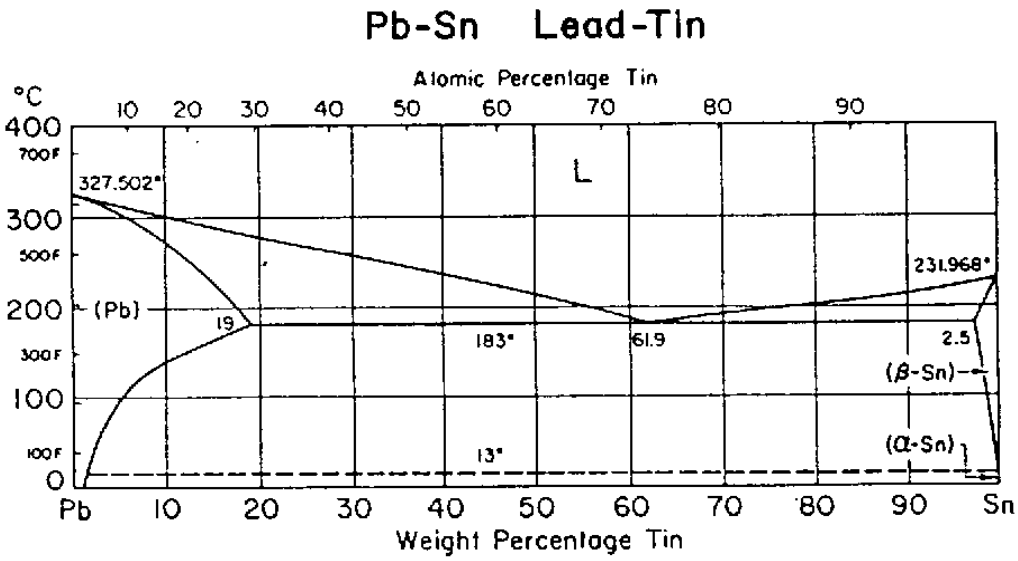
1. From the Mg – Ni equilibrium diagram:



a) Point the phases present in each of the regions of the diagram.
b) Indicate the triple points present in the diagram by its composition-temperature coordinates, determining which type of transformation is associated to each one of them.
c) Calculate the estechiometry of the intermetallic compounds present.
d) Justify the composition of the alloys that could contain (Mg) and (Ni) in their microestructures as primary phases. Indicate if there is any other primary phase is this system.
e) Draw an schematic of the microstructure that will present an alloy 23,5% of Ni and another one of 40% Ni both at 400ºC. Indicate the composition and quantity of each one of the fases present, calculating the percentajes of primary phases in each case.
f) Determine the chemical composition of the alloy that has 35% of γ primary phase in its microstructure.

Given: M (Mg) = 24,3 g/mol M (Ni) = 58,71 g/mol

2. From the Lead-Stain phase diagram, calculate:



a) For an alloy of 15% Sn, determine:
   1. The composition of the first solid formed.
   2. Liquidus temperature
   3. Solidus temperature

4. Solubilization temperature
5. Solidification interval

b) It is known that one the alloys of the system contains 45% of phase (Pb) ad 55% of phase (β-Sn) at 100 ºC. Determine:

1. Composition of the phases
2. Is it hipoeutectic or hypereutectic?
3. Proeutectic phase percentage
4. Percentaje of Pb from eutectic origin.

c) For an alloy of 15% Sn, determine:

1. Composition of the phases present at temperatures of 300, 220, 182 y 20 ºC
2. Schematic of its microstructure at the same temperatures.

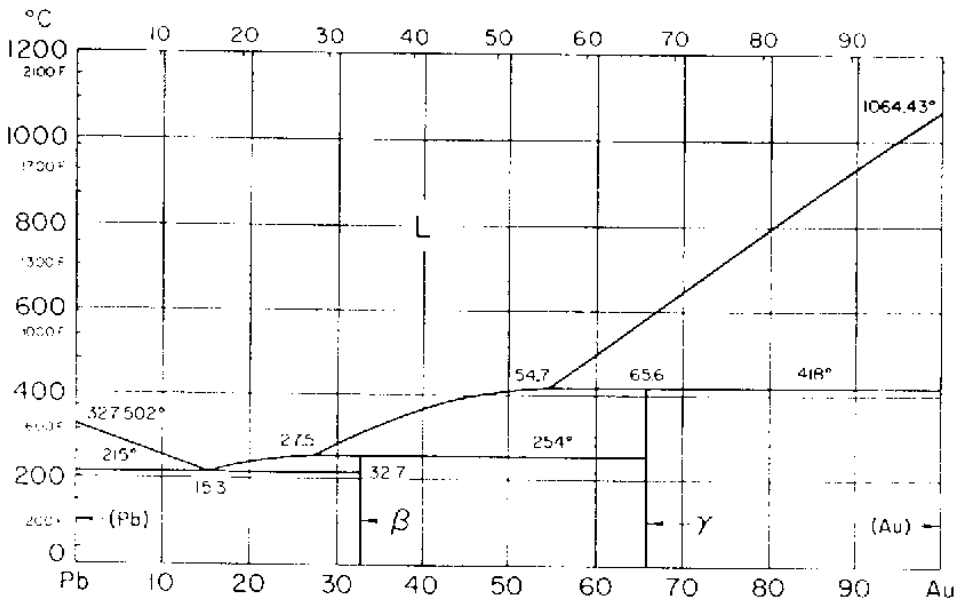
d) Define an alloy to repain a component that fits the following requirements:

- Melting temperature under 230 ºC
- Minimum content of liquid phase of 70%
- Pb percentaje not under the one of in the eutectic composition

3. From the following equilibrium diagram Au-Pb:

a) Point the phases present in each one of the regions of the diagram.

Porcentaje Atómico de Oro



Porcentaje en Peso de Oro

b) Show the triple points in the diagram, pointing its temperature and composition coordinates, and determine which type of transformation is associated to each one of them.

c) Calculate the stechiometry of the intermetallic compounds β and γ

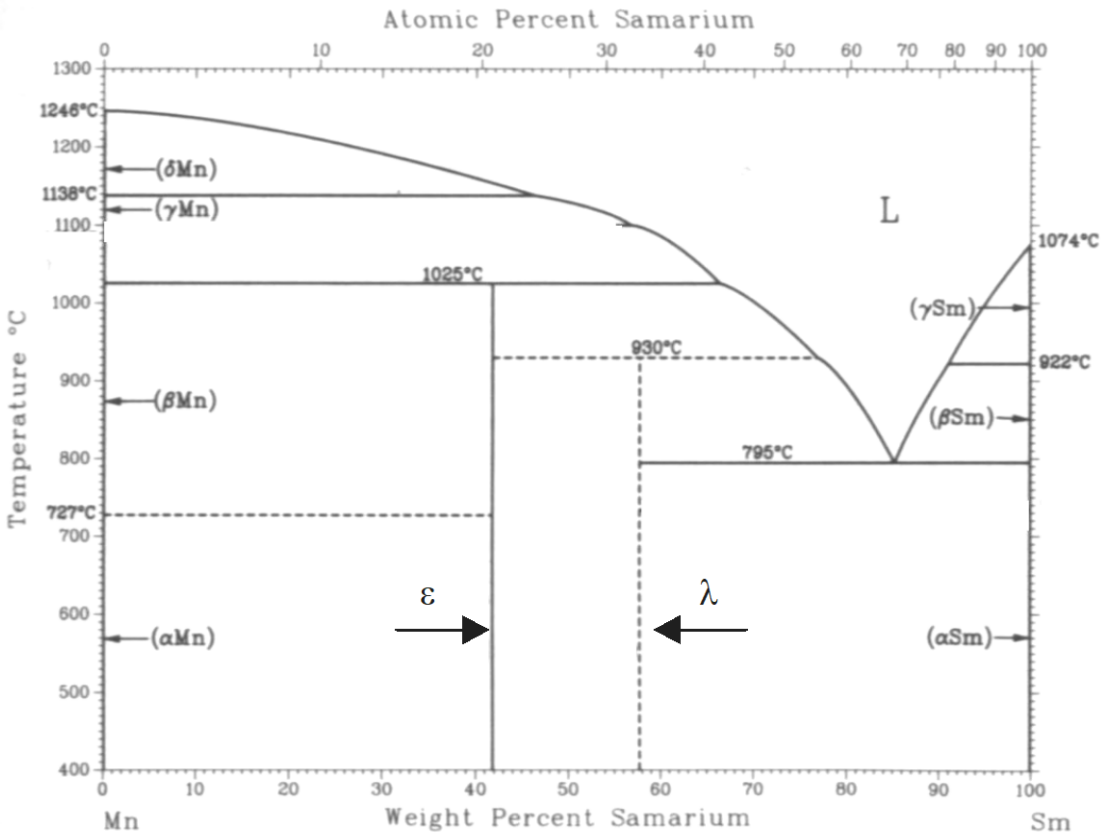
d) Draw an schematic of the microstructure of the alloy Pb-10%Au at the temperatures of 600°C, 215+ΔT°C, 215-ΔT°C and room temperature. Indicate in all the cases the percentajes of phases present and its chemical composition.

e) Calculate the density of Gold, knowing that it chrystalizes in a FCC system an has an atomic radio of 1.44 Å

Given: M_{Au} = 197 g/mol ; M_{Pb} = 207,2 g/mol ; N_A=6,023·10^{23} mol^{-1}

4. From the Mn – Sm phases diagram:

a) Identify on the diagram the phases present in each one of the regions.



<u>Given</u>: M(Mn) = 55 g/mol M(Sm) = 150 g/mol

b) Establish the intervals of temperature in which Mn alotrophic forms exist.
c) Which is Sm melting point?
d) Indicate the temperature-compositon coordinates of the points where any freedom degree does not exist. Cite the transformations associated to each one of them.
e) Calculate the estechiometry of the compound λ.
f) Determine the composition and proportion of the phases in an alloy that has 60% of Sm at 900ºC.
g) Draw an schematic of the microstructure of the alloy Sm-20% Mn at room temperature, calculating the composition and relative proportion.