Lecture 26 Common binary alloys

Questions:

1. Which lead – tin alloy will be ideal for joining electronic assemblies? Give reason.
2. Why is Al-12% Si alloy a very popular casting material for automotive applications?
3. Cartridge brass is easily cold worked but Muntz metal can not be cold worked. Explain why it is so.
4. What is the diffrence between disordered & ordered $AuCu_3$ alloy? How is the presence of ordered structure detected?

Answers:

1. Eutectic composition is ideal. It has 62Sn 38Pb. It melts at a fixed temperature. It flows easily into tiny gaps which is the essential criteria for joining electronic assemblies.
2. Apart from light weight it has excellent castability. By modification it can be made to solidify as complete eutectic structure. Most metals (inculdes Al) contract on solidification. Si exapnds on solidification. Al-12Si is an optimum combination where there is little shrinkage on solidification. It is therefore easy to produce defect free casting with no shrinkage cavity.
3. Cartridge brass has 70%Cu & 30% Zn. A look at Cu-Zn phase diagram shows that it is a single phase alloy. Therefore it can be deformed / shaped easily by cold work. Muntz metal on the other hand had 60%Cu40%Zn. It falls within $\alpha+\beta$ region of phase diagram. β is relatively brittle at room tem[perature. A two phase structure is always difficult to cold work. However if heated it goes to a single phase region. This is where it is amenable to working. (It can be hot worked)
4. In disordered state both Au & Cu atoms are distributed in both cube corners and face centres in proportion to their respective atomic percent. Virtually each atom could be assumed to be made of I part of Au & 3 parts of Cu. In ordered state all Au atoms are located in corner sites & Cu atoms occupy face centres. These sites are in ratio 1:3 in fcc lattice. This is best detected by powder X-Ray diffraction technique. Disordered structure gives reflections corresponding to fcc lattice where as reflection form ordered structure corresponds to simple cubic lattice. Additional reflections are called super lattice reflection.