

ON THE POSSIBILITIES OF PRODUCING NEW METASTABLE PHASES BY
CO-EVAPORATION OF ELEMENTS NON-MISCIBLE IN THE LIQUID STATE

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The co-evaporation technique, normally used as a vapour quenching method, can also be profitably employed to prepare binary phases of metals nonmiscible in the liquid state.

Thanks to this technique we obtained the new Ni As type phases Ni Pb , Ni Ti and Fe Pb. Some theoretical implications on Ni As type phases have thus been made possible.

DISCUSSION :

- P. Duwez : Are FePb and NiPb ferromagnetic ?
- R. Ricci Bitti : The layer was always a mixture of phase (NiPb or FePb) and Pb. For this reason it was in practice difficult to carry out magnetic measurements without separating the two phases. Nevertheless we observed two cases where the powder produced by co-evaporation was attracted by a permanent magnet.
- E. Babić : May I ask you about the temperature of the substrate and the substrate structure ?
- J. Dixmier : The substrate was glass at room temperature.
- R. Sofrenović : Does it mean that by direct co-evaporation you were not able to produce metastable NiPb phase ?
- J. Dixmier : No, by coevaporation we obtained the NiPb phase. We have just said that when the evaporation of the two elements is not simultaneous but successive you have a two layer sandwich of the two elements without forming the NiPb phase by diffusion.
- R.W. Cahn : Is not the probability of a direct collision between Ni and Pb atoms, moving on straight lines, vanishingly small ?
(Was the vacuum good enough to give mean free paths large compared with the source-substrate separation ?)
- R. Ricci Bitti : We think that with the rapid evaporation rate we have chosen the pressure was about 10^{-1} mm Hg. So, the probability of collision between 2 atoms was of the order of 80%, in the cross section of the two vapour streams, but outside of the cross section, taking into account the directionality of collision it is not high and we can consider that the formed NiPb complex goes straight to the substrate.
- K. Mukherje : I have a question regarding the point raised by Dr. Cahn. I would like to know what proportion, say volume percent, of the new metastable phase you get on the substrate ?
- R. Ricci Bitti : We did not measure that proportion. But if we consider the relative intensities of X-ray lines of the phases (NiPb+Pb), the volume percent of NiPb phase seems to be about 10 to 20%.