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DISCUSSION:
TRANSFORMATIONS AND INTERFACES I

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Three main topics were covered in this session:
- Magneto-elastic effects;
- Internal friction in metallic glasses;
- Internal friction in aluminium alloys.

As regards magneto-elastic effects no comments nor questions were made.

INTERNAL FRICTION IN METALLIC GLASSES

Concerning the work of POSGAY et al., the question was raised whether the decrease in internal friction and the increase in dynamic modulus could be connected to short range topological order?

Dr. KISS replied as follows:
The decrease in internal friction due to an applied stress can be effectively connected to topological ordering or decrease of the so-called quenched-in free volume. In the case of crystalline materials it is the opposite case: at large stress (about 10% of the yield stress) defects can be produced and an increase in internal friction is observed.

Another interesting feature is that, in Mo alloys, a decrease in internal friction was observed at low stresses followed by an increase at higher stresses as normal in crystalline materials. The specimens were produced by sintering and the applied stress could possibly compact it and the decrease in internal friction can be considered as normal.

Dr. KISS also observed that in several papers dealing with amorphous materials, it was not possible to find results about dynamic modulus, which is frequently the more significant parameter. It is suggested that dynamic modulus should be systematically measured as well as internal friction.

Concerning the paper of BOUQUET et al.: During the second stage attributed to structural relaxation in the glassy matrix, the authors observed an internal friction maximum probably connected to coherent domain formation or a spinoidal decomposition effect of the type observed in amorphous phase separation. Have the authors performed other observations, like T.E.M., to see whether it is possible to effectively observe coherent domain formation or amorphous phase separation after the second structural stage.

Dr. ABOKI: In our work on ferromagnetic amorphous alloys, stage two corresponds to structural relaxation and we suggest that, in that case, two phenomena occur: one corresponding to the beginning of the increase in internal friction, due the elastic energy release, and the second due to chemical ordering. We believe that the relaxation phenomena at higher temperatures correspond to the Curie transformation but no measurements under magnetic field could be performed.

In reply to Dr. KISS, Dr. ABOKI said that in their experiments measurements on the dynamic modulus were always performed. He agreed with the interpretation of the decrease in internal friction in terms of topological or geometrical short range order, but pointed out that in the measurements by Kiss et al. mechanical treatments can induce mechanical annealing, just opposite as in crystalline materials: the background is lower and decreases instead of increasing, which seems to correspond to densification or sintering.
The discussion concerning grain boundaries considered first some uncertainty in the paper of Yang and Kë, about the amount of variation of the dynamic modulus (60% or 2000%?) and about its high frequency value (above the relaxation phenomena) which seems not to agree with that of aluminium. Also in relation with this paper, it was questioned whether the observed spectra were stable, considering that the measurement temperature was only 6° below the annealing temperature. Dr. YANG replied that the spectra were stable indeed.

About the paper by GONDI et al., it was pointed out by FANTOZZI that their peaks $P_1$, $P_2$ and $P_3$ are not relaxation peaks, but just peaks as a function of time, which could lead to confusion. Asked about the interpretation of these maxima, Dr. GONDI replied as follows: I have to mention that we are in a condition where, according to our interpretation and that of WOIRGARD, dislocations give an appreciable contribution to internal friction. If we further introduce dislocations inside the grains, we obtain an increase in internal friction; when dislocations then go to polygonization walls we obtain a normal decrease in internal friction. So we observe internal friction maxima (as a function of time) corresponding to the introduction of dislocations in the grain interiors and elimination in the walls or sub-boundaries. What we observe is mainly grain growth and not just primary recrystallization.

As asked whether the peaks observed by URRETA et al. and by ZHENG KEQUIN et al. are identical, Dr. URRETA answered that the peaks are different, since they have a different behavior during annealing. The peak we observed shifts towards lower temperatures and tends to vanish when the temperature is increased. The peak observed by ZHENG KEQUIN has an opposite behavior.