THE INTERPHASE β' → ζ TRANSFORMATION OF QUENCHED ALLOYS OF Ag-Zn SYSTEM (27–48 wt %Zn) REGISTERED BY THE ELECTRIC RESISTIVITY METHOD APPLYING HEATING

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ABSTRACT. The difference of the specific electric resistivity at investigated alloys resulted of the interphase transformation shows that:

- the metastable β' - phase, formed by quenching of the alloys of the β - phase region to 0°C, egzists between 29 and 46 wt %Zn.The maximum of the retention is at the equiatomic alloy (38,2 wt %Zn), which correlates with the results of the previous research of the same alloy by a thermal dilatometric method.
- the β' → ζ transformation occurs between 100° and 175°C, with the begining of the interphase transformation from 100° to 140°C

INTRODUCTION. The equiatomic alloy of the Ag-Zn system (Fig.1) has been subject of mainy investigations with intention to determine the kinetic of the interphase transformation β ⇄ ζ ← β' and also the temperatures of their mutual transformation. The investigations of Weerts[1], Köster[2], Edmunds[3], Kichingman[4], Clark[5], Noguchi[6], Arias[7], Kittl[8] and other authers for the alloys pretty near (38,2 wt.%Zn) show that the stable disordered β crystals at high temperature quenched in water and ice had structure of CsCl type (ordered β' phase) which quenched in a case below a room temperature did not change its structure. The formation of the ζ - phase occurs by cooling of the β -crys-

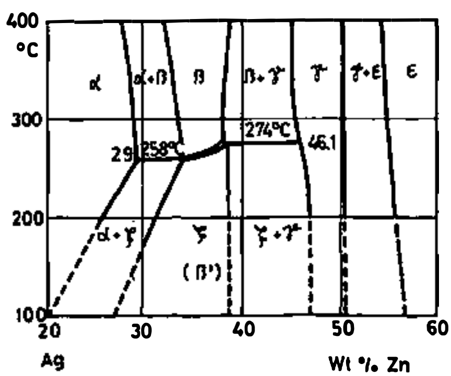

Fig.1

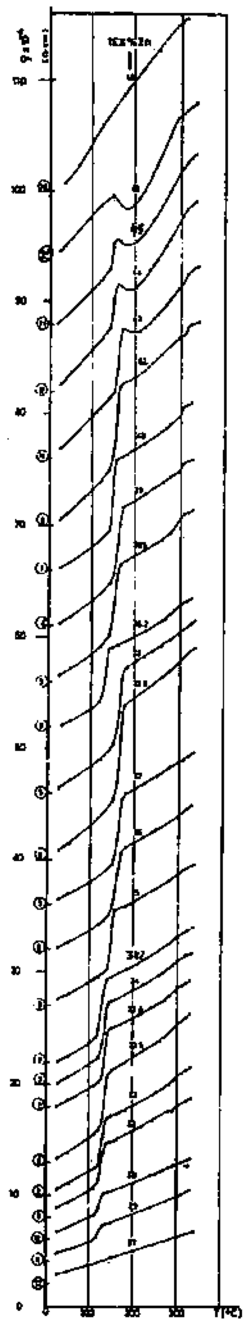

Fig.2

tals or by heating the β' -phase from a room temperature to the temperature higher than 100°C.

Experimental investigations by thermal dilatometric method[10] of aspect to the posibilities for formations of the β' -phase in a larger composition interval and the temperature interval in which the $\beta' \rightarrow \zeta$ transformation occurs showed that the metastable β' -phase has formed into a wide interval (29–46 wt %Zn) and by heating it has transformed to ζ -phase between 110-175°C.

EXPERIMENTAL SET UP. The 24 alloys (27–48 wt %Zn) were quenched from 320° i.e. from 290°C respectivly, at which temperatures they were kept for 30 minites, and after that rapidly were settled down to 0°C.

The experimental values of the electric resistivity were obtained by Tomson's brigde (TETTEX). The sample temperature (340°C) is measured by thermocouple Fe-constantan, and the heating velocity was into 1 - 2°C/min interval.

REZULTS AND DISCUSSION. Fig.2 presents the specific electric resistivity versus the temperature (ρ=f(T)). The amount of Zn in the alloys is denotted on each curve which due to composition are shifted along the ρ -axis. The values of ρ for every ρ=f(T) are obtained by the differences of the values on the scale in the interval between the beginning and the end of it and with addition the value notted (in circle) at the beginning of each curve.

It is evident from the curves (Fig.2) that a fast change of ρ between 100-175°C (29-46 wt %Zn) which coresponds to the $\beta' \rightarrow \zeta$ phase transformation takes place. It depends on the amount of Zn in the alloys up to 37,8 wt %Zn, but over 38 wt %Zn it decreases and takes a value of zero at 48 wt %Zn. The temperature interval of the $\beta' \rightarrow \zeta$ transformation increases as well as the Zn increases in the alloys up to 37,8 wt %Zn and it shifts to higher temperature. At the alloys 39-46 wt %Zn, after the increasing of ρ concerned to the $\beta' \rightarrow \zeta$ transformation, a new change of ρ is evident which forms a minimum by increasing of Zn in alloys. It is shifted to the lower temperature (200-180°C). Probably it is resulted by changing the electronic proprties of alloys influenced by the intermetallic compound Ag_5Zn_8 (48,7 wt %Zn) with a γ-brass stucture and the raised number of vacances in the ζ-phase formed by the $\beta' \rightarrow \zeta$ transformation above 175°C temperature.

For the 260-300°C temperature interval the curves (29-46 wt %Zn) show another increasing of δ which is concerned with the transformations in them along eutectoid and peritectoid lines (Fig.1).

Almost all curves $\delta = f(T)$ (39-46 wt %Zn) between 0-100°C have a pretty parallel course, but with bigger coefficient of increasing of δ for the two-phases region $\beta' + \gamma$ or $\zeta + \gamma$. At the same alloys the coefficient of $\delta = f(T)$ increases faster at higher temperature from (200°-180°C) to 300°C, in comparison to one of $\delta = f(T)$ up to the alloy 39 wt %Zn in the same temperature interval. Most probably such behaviour is a result of the higher presence of γ-phase with higher value of δ compared to the other pure phase (α, β, β' and ζ).

The diagrams δ-concentration (isotherms, Fig.3) are formed from the experimental results (Fig.2). Over the isotherms, the phase diagram of Ag-Zn is projected with coordinates: apscissa-concentration and right ordinate-temperature. The course of the isotherms and their interdistance show that:

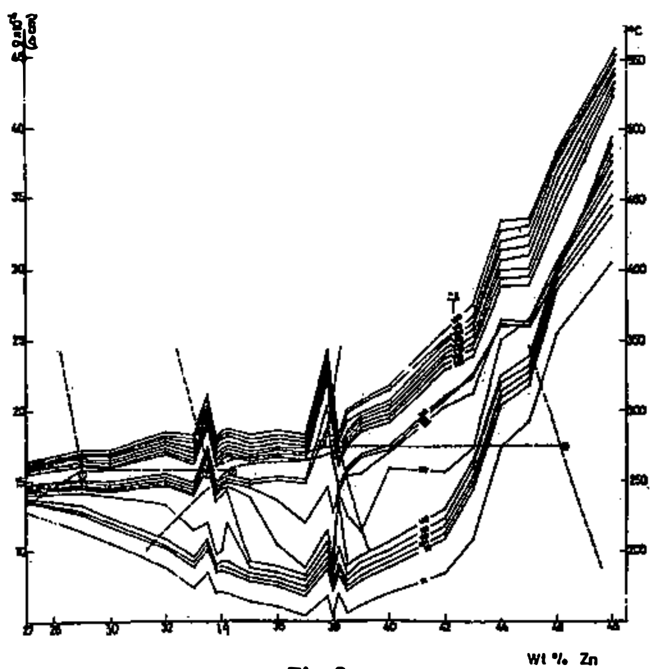

Fig.3

- the isotherms till 116°C and between the 175°-320°C are almost parallel. The isotherms 164°, 176° and 188°C resign of the parallel course. They are folded over due to the change of ρ immediatly after the $\beta' \rightarrow \zeta$ phase transformation, concerned to the major number of vacances[6] in the ζ - -phase and the defect structure in the γ-phase[9].
- the isotherms between 104°- 176°C have larger and different interdistance depending on the concentration and temperature (100°-175°C) intervals as follow:

	between	29 and 34,2 wt %Zn	from	104° to 140°C
	"	34,2 and 38,2 wt %Zn	"	128° to 176°C
	in	38,2 wt %Zn	"	116° to 140°C
and	between	38,5 and 43 wt %Zn	"	140° to 175°C

which results from the $\beta' \rightarrow \zeta$ phase transformation.

- the ρ changes over temperature 258°C belong to those of the Ag-Zn phase diagram.

Accepting that the magnetude of $\Delta\rho$ for 1°C is a measure of the retention of the β' -phase at room temperature, it is maximum at 38,2 wt %Zn.

CONCLUSION. From the presented experimental results it follows that:

- the metastable β'-phase obtained by quenching of the β -phase region exists in a wide concentration interval (29-46 wt %Zn), with maximum of retention at 38,2 wt %Zn.
- the temperature for the $\beta' \rightarrow \zeta$ transformation is placed in the interval 100°- 175°C.
- the maximimum and the minimum values in the courses of the isotherms (Fig.3) are in relation to the phase diagram, i.e. the characteristic points ②, ③, ④ and ⑤ are influenced by the formation of the β' -phase and the grain structure of the alloys,too.

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