CONSIDERATIONS ON THE POSSIBILITY OF A SINTERING MANGANESE LOW ALLOY STEELS

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Abstract: *Experimental research on the sintered steels with manganese own, in mixtures of powders obtained lead to the conclusion that in order to achieve homogeneity of the structural and mechanical characteristics comparable to those of the alloy steels commonly used in the powder metallurgy industry required high sintering temperatures and times . (1250 ° C and 120 min.).*

Keywords: steel sintered, sintering process, manganese, copper.

INTRODUCTION

The problem of the activation of the sintering and formation of the alloy, the sintering temperature to reduce the duration and the current becomes great both from the economic point of view. [1] [3]. Enabling sintering powders improves contact between particles and enhances transport of material between adjacent powder particles, and that which leads to improved physical and mechanical property alematerialelor sintered. The literature mentions several physical and chemical methods of sintering activation [2], 13], the main being:

• sintering variable fields (ultrasonic, induction, etc..)
• use of powders mechanically deformed (hardened) or irradiated;
• adoption of allotropic transformation temperatures around;
• use reactive sintering atmosphere;
• presence of low concentrations of alloying elements;
• use of mutual solubility of alloying elements;
• sintering in the presence of a transient liquid phase;
• cycles of oxidation / reduction of metal powder metal compacts.

Activation of sintering processes applied to sintered steels are considering an accelerated alloy by increasing the diffusion coefficients in volume and density of fine structural defects.

EXPERIMENTAL DATA

Nowadays many researchers are studying the possibility of activating sintering manganese steels appealing to transient liquid phase sintering, purpose in proposing the use of additional alloying elements (boron, phosphorus, nickel) introduced in low concentrations [2] [4].
Figure 1 is the main alloying element concentrations determined by the assay microspectrală Rongen, the X-ray beam passing through the boundary between the two Graun crystalline. The test is performed on a chip of Fe-Mn-Cu by heating for 10 min. to a temperature of 1210 ° C [4].

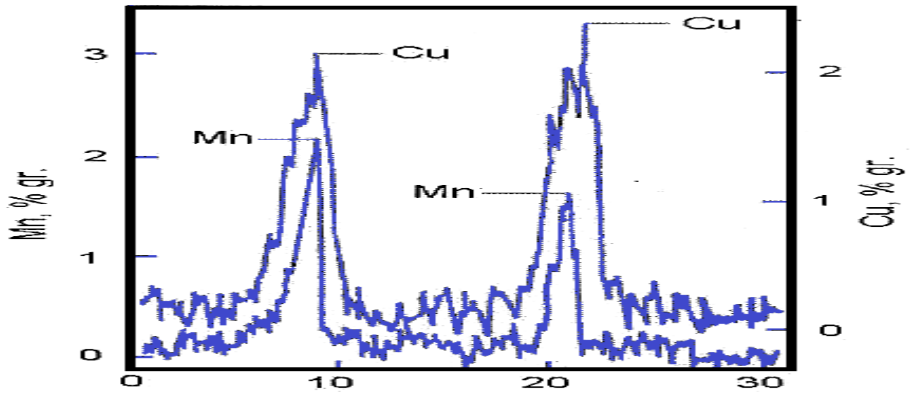

Fig. 1. Manganese and copper concentration profile resulted from the analysis microrongenospectrală

In the first stage of homogenization of the material is found that manganese and copper a concentration of crystalline grains limits of 2% and within the grains do not yet appear main elements added, Mn and Cu. This finding indicates that immediately after melting master alloys dissipates only crystalline grains within the particles of iron. Copper and manganese concentration changes in the boundaries of crystalline grains. Based on these observations others have assumed a model of mixing in this liquid phase diffusion based on Mn-Cu grain boundary towards their center. By determining a pattern of variation of the concentration depending on the crystalline grain boundary of time in figure 2.

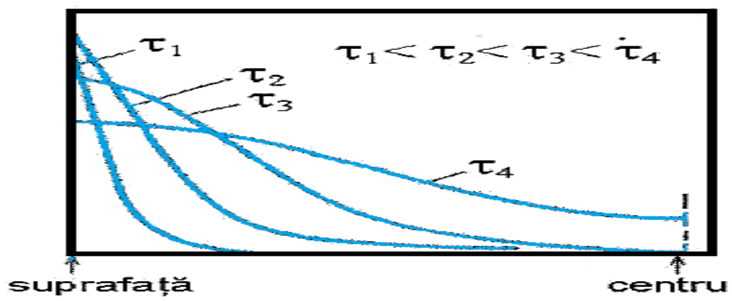

Fig. 2. Varying the concentration of the alloying elements diffusion homogeneous

The kinetics of full homogenization is shown in Figure 3, where the change in the concentration, C, is given to the length of D / a 2 (- length of diffuser, a - crystalline grain size D of the diffusion coefficient).

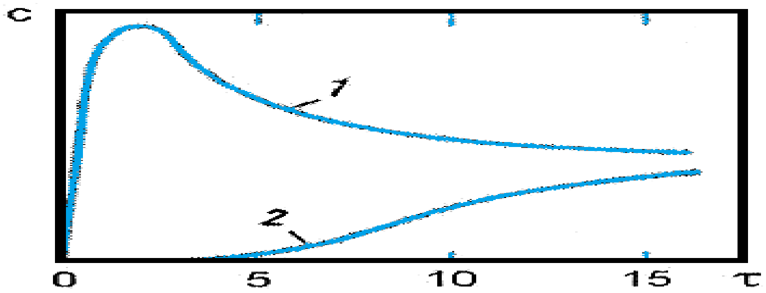

Fig. 3. Kinetic curves mixing 1 - the edge crystalline grains, 2 - in the center of the crystalline grains.

Considering a single crystalline grains in the first stage of chemical homogenization, after the appearance of the liquid phase, there is a significant increase in the content of alloying elementebor to limit grain while the grain center concentration of alloying elements remain zero.

In the second stage of homogenization occurs and results in scattering volume occurs around vaborilor concentration of alloying elements corresponding limit crystalline grains and grain center.

Microscopic structure of the material analyzed with SEM micrograph showing the degree of dissipation complex mixtures of copper powder ferro in figure 4

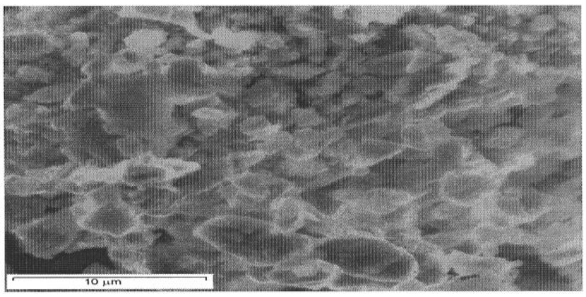

Fig. 4 . SEM micrograph of Fe -Mn -Cu steel .

As can be seen in Figure 4 which copper is marked by red dots and particles are milled powder obtained by grinding are small size and irregular shape .Hence the crystalline grain size plays an important role because it actually determine the path length of diffusion in volume - diffusion type which corresponds to the lowest speed which contribute to the development of the mixing process .

In conclusion, we can say that the acceleration alloy formation can be achieved by introducing iron powder alloying elementebor fusible alloy as a sintering temperature below which the melt forms a transient liquid phase . Accelerated penetration of alloying elements within the iron particles occurs by intergranular diffusion , completely homogeneous diffusion find related course in crystalline grain volume .

CONCLUSIONS

Based on these considerations shown to activate sintering powder mixtures of iron and ferro-manganese, in the research covered in this chapter were adopted two activation methods:

a) To increase the degree of dissipation of the manganese and copper in the iron powder by grinding prior ferro with a part of the iron powder;

b) formation of a transient liquid phase sintering manganese steels by adding copper I (0-3% wt. Cu). Copper was added iron powder form of complex powder mixture obtained by grinding in a planetary mill powder mixture of ferro-manganese and copper powder so formed as to lead to different concentrations of copper and manganese in final mixture;

c) introducing the mixture of copper powder pigmentation consisted of lamellar powder, copper powder, manganese.

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