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THE INFLUENCE OF THE METAL BATH STIRRING ON THE DEOXIDIZATION PROCESS

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ABSTRACT
The metal bath stirring accelerates the processes of deoxidised diffusion, of oxide particle increase by coalescence, of conglomerate formation by an increase in the number of particle collisions, as well as the final settling of the suspensions from the metal bath. The paper introduces the influence of metal bath stirring upon the process of removal of oxygen, and non-metal inclusions. We gave the results for baths stirred inductively and by argon bubbling, both continuously and intermittently.
Keywords: steel, deoxidation, aluminium, oxygen, stirring.

1. INTRODUCTION
The metal bath stirring accelerates the processes of deoxidiser diffusion, of oxide particle increase by coalescence, of conglomerate formation by an increase in the number of particle collisions, as well as the final settling of the suspensions from the metal bath.
An intensification of the settling processes in metallurgic installations is practically achieved by electromagnetic stirring (induction) of the metal bath or by bubbling with an inert gas, usually argon, carbon dioxide or nitrogen, for the steel grades micro-alloyed with nitrogen. It is obvious that too violent a stirring could reintroduce into the melt the particles already settled, which would impurity the steel in the long run [1, 2, 3].

2. EXPERIMENTS AND RESULTS
In order to determine the influence of bath stirring upon process of inclusion removing from the stirred baths, when deoxidisation is done with aluminium, we experimented on ten charges (tab.1) [4]. The stirring of the metal bath was done inside the oven, both by induction and by argon bubbling, the results being given analytically and graphically in fig.1 and fig.2.
The presence of a gaseous stage inside the metal bath can accelerate considerably the process of suspension in, particularly for large of liquid steel.
An analysis of the correlations obtained the point of view of the correlation coefficient, will show that they render very accurately the evolution of oxygen content inside the bath, for all the variants under consideration, which is also confirmed by the graphical representation of these correlations, as well as by data in the reference material.
The graphical representation of these correlation points out clearly to the influence of bath stirring upon the process of oxygen removal, it being more intense in the case of argon bubbling; this can be explained by the favourable thermo-dynamic conditions created at the limit between the gas bubble and the suspension particle, along side with the apparition of absorption phenomena.
We can also notice very clearly the influence of stir interruption upon the process of non–metallic inclusion removal (fig.3) especially with inductive stirring.

Table 1.The characteristics of lab-elaborated charges

No. charge	Quantity Elaborated, [t]	Capacity ladle, [t]	Deoxidizer [kg/lump]	Addition of deoxidizer		Notes
				[kg/ladle]	[%]	
1	100	100	Al; 0,050	0,151	0,141	not stirred bath
2	100	100	Al; 0,025	0,150	0,140	not stirred bath
3	100	100	Al; 0,050	0,152	0,145	induction stirred bath
4	100	100	Al; 0,025	0,149	0,146	induction stirred bath
5	100	100	Al; 0,050	0,148	0,145	induction stirred bath
6	100	100	Al; 0,025	0,149	0,144	induction stirred bath,
7	100	100	Al; 0,050	0,149	0,143	argon bubbled
8	100	100	Al; 0,025	0,151	0,144	argon bubbled
9	100	100	Al; 0,050	0,152	0,146	argon bubbled
10	100	100	Al; 0,025	0,152	0,142	argon bubbled

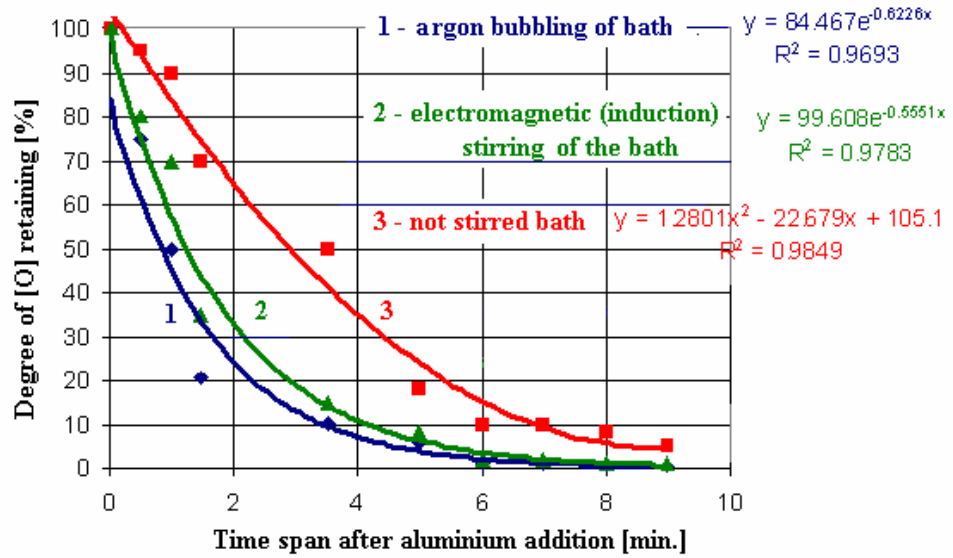

Figure 1. The evolution of degree of oxygen retaining in the metal bath, with respect to time and type of stirring

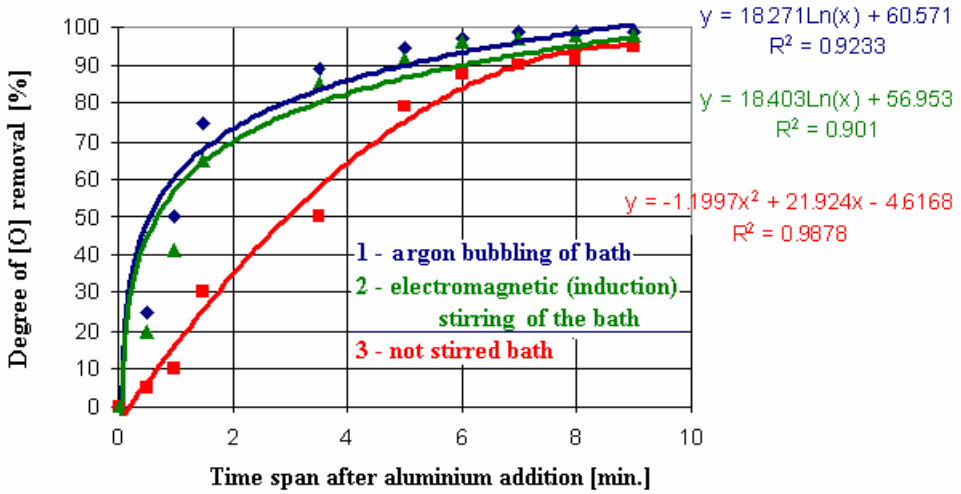

Figure 2. The evolution of degree of oxygen removal from the metal bath, with respect to time and type of continuous stirring

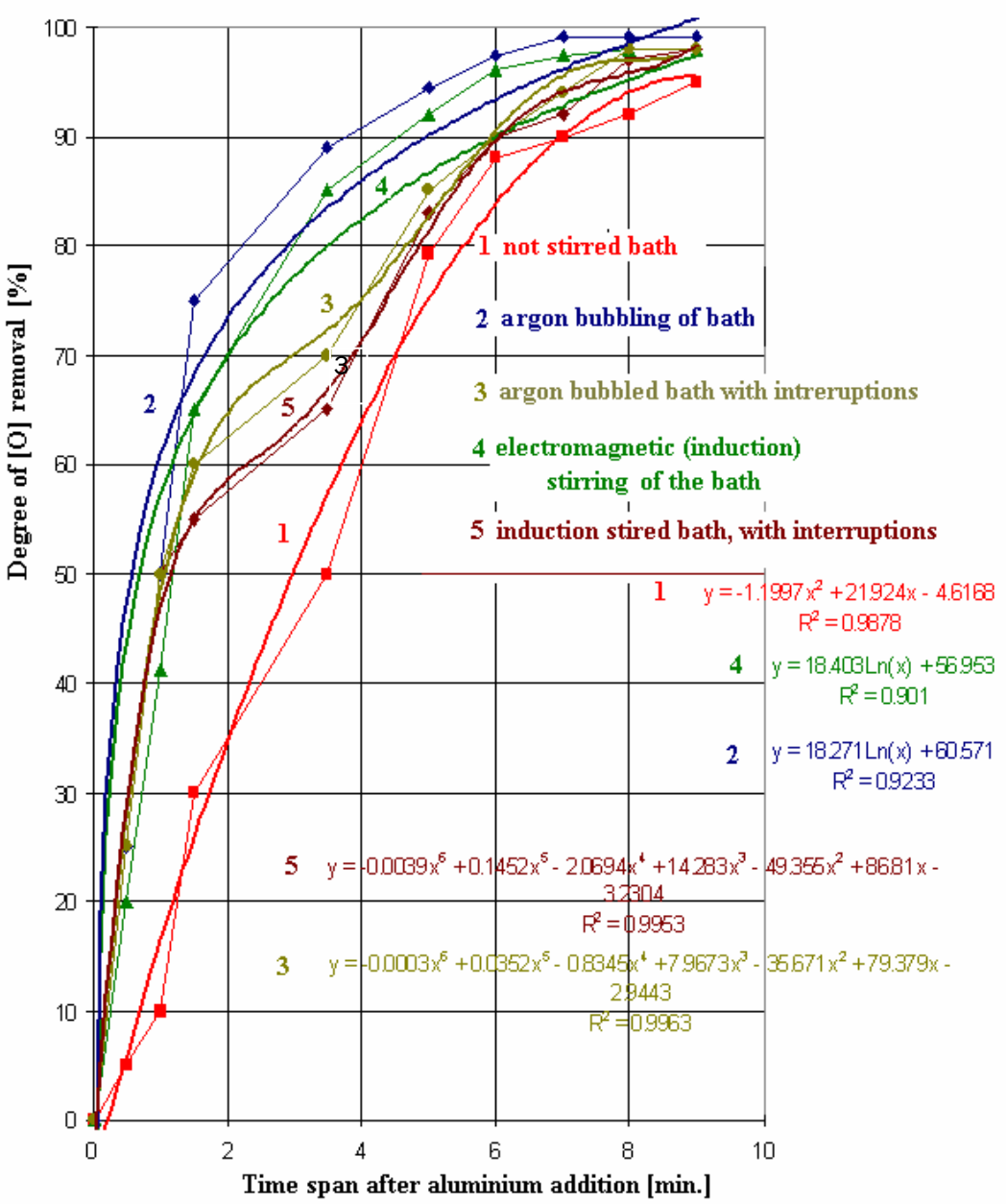

Figure 3. The evolution of degree of oxygen removal from the metal bath, with respect to time and type of stirring

3. CONCLUSIONS

The experiments we have carried out and the processing of the data by means of the EXCEL spreadsheet program resulted in the flowing conclusions:

- We have demonstrated the influence of the type of bath stirring upon the process of oxygen removal from the metal bath, this dependence being expressed both graphically and analytically;
- Better results are obtained in the case of bath stirring with inert gases, usually argon;
- An interruption of the metal bath stirring results in a reduction of the oxygen removal process, but after resuming in the stirring it shows intensification.

4. REFERENCES

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