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ON THE INTERACTION BETWEEN MOULD OSCILLATION AND MOULD LUBRICATION IN VIEW OF STRAND SURFACE QUALITY

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1. Introduction: In the continuous casting of today, one of the most important tasks is to realize the high potential in energy savings by hot charging or even direct rolling. Such processing poses high requirements on product surface quality.

One persistant weakness is the presence of oscillation marks. In order to reduce their depth, the effects of mould oscillation and lubrication must be understood. As to this interaction, several outstanding studies[1)-4)] have been published recently. The present investigation is aimed to give a further contribution.

2. Investigation Procedure: Observations on the oscillation mode, mould powder properties and other conditions have been gathered from several casters and evaluated particularly in view of oscillation mark depth. Thereby, the focus was laid on steel grades with most pronounced mark formation i.e. plain carbon steel around 0.1 % C and austenitic stainless steels with Ni'/Cr'-ratio of about 0.55.

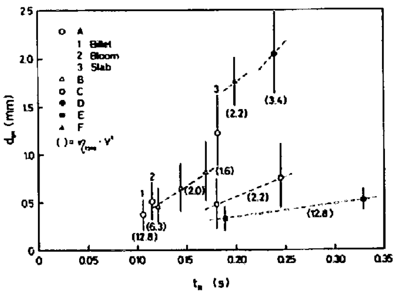

Fig. 1 Relationship between d_{OM} and t_N from several casters (full symbols = low carbon steel, open symbols = stainless steel)

3. Results and Discussion: As shown in Fig. 1, the depth of oscillation marks d_{OM} appears to be strongly dependent on negative strip time t_N, but also powder consumption P is a significant factor (Fig. 2). The further analysis of these data indicates that powder consumption is affected only marginally by the oscillation mode i.e. slightly increasing with higher negative and positive strip time, thus, also with total cycle time. Rather, powder consumption essentially depends on the balance between slag viscosity (for constant melting rate) and casting speed (Fig. 3).

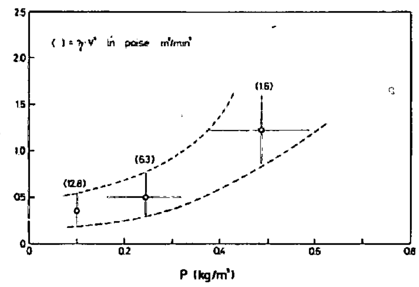

Fig. 2 Dependence of d_{OM} on P (caster A)

4. Conclusion: The product surface quality should be controlled primarily by careful mould powder selection which has two beneficial effects to minimize oscillation mark depth:

- a stable slag film with minimum mould friction will reduce the deformation of the meniscus shell;
- the optimum powder consumption required for slag film stability will also avoid excessive slag being pressed into the oscillation mark.

Consequently, the permanent control of mould friction and powder feeding rate are primordial elements in the realization of high surface quality.

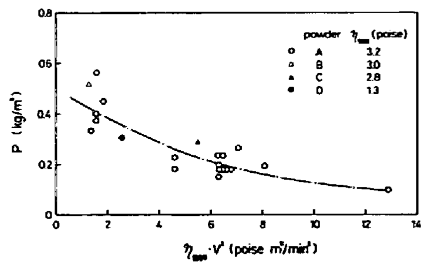

Fig. 3 Effect of $\eta \cdot V^2$ on P (caster A)

5. References: 1) T. Emi et al.:3rd IISI-Congress, Chicago 1978. 2) T. Nuri and T. Ohashi:98th ISIJ-Meeting, Nagoya 1979. 3) H. Tomono:Doctoral Thesis, ETH, Lausanne 1979. 4) T. Kitagawa and M. Ishiguro:4th Japan-Germany Seminar, ISIJ, Tokyo 1980.