669.15'24'26-194.56: 536.421: 621.744.3
621.746.558-837: 621.746.047: 621.746.27: 621.746.393.047 '80 — S 221

(193)

On the Solidification Behaviour of Austenitic Stainless Steel in the Continuous Casting Mould

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1. Introduction: Continously cast strands of austenitic stainless steels, type SUS 304, can show intermittent occurrence of surface depressions, mainly depending on mould powder characteristics (1), but also on mould cooling water velocity (2). Static casting experiments have shown that these depressions form by strong inward bending of the shell below the meniscus (3). In the depression area, primary austenite is found while the shell part with normal growth showing primary ferrite (4).

2. Investigation Procedure: From a large number of austenitic stainless steel strands, the depression frequency has been correlated with the ferrite/austenite fraction formed during solidification as derived from steel analysis by applying the proper Cr- and Ni- equivalents (5). Furthermore, also observations on mould heat flux and mould friction have been evaluated as function of casting speed and mould powder properties in order to identify the most stable conditions.

3. Results and Discussion: As shown in Fig. 1, the maximum depression frequency is found in coincidence with complete ferritic solidification and peritectic transformation following immediately afterwards which is known to give a maximum shell contraction (3). Furthermore, depression formation is enhanced with increase of mould heat flux and mould friction.

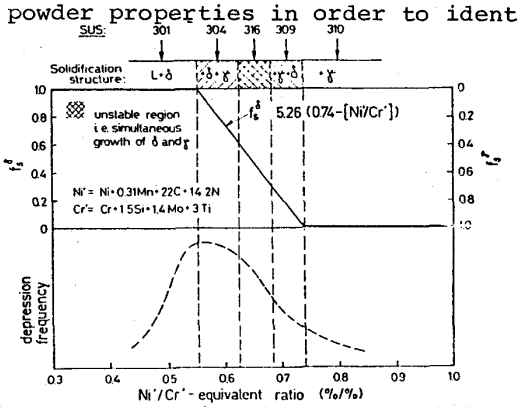

Fig. 1 Depression frequency and ferrite/austenite fraction as function of Ni/Cr-equivalent ratio

The correlation of Cr- and Ni-equivalents with detailed data on solidification structures (6) indicate that Ni'/Cr'-ratios around 0.65 might be characteristic where primary ferrite changes over to primary austenite in case of low cooling rates, i.e. at depression site, whereas austenite being suppressed in favour of ferrite formation at higher cooling rates.

4. Conclusion: The formation of depressions is not only dangerous due to shell thinning, but, with the increased austenite fraction, also microsegregation and crack sensitivity will increase (7). Most effective countermeasures are minimization of mould heat flux and mould friction by proper balance of mould powder characteristics.

5. References:

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