(1) In this modelling, fraction solid was increased very rapidly just below liquidus temperature, and thus the temperature where the beginning of solid bridge was formed was very close to the liquidus temperature. Therefore, the temperature range where the residual liquid was confined by the sllid bridges was very long.

(2) These behaviors mentioned in (1) were fitted well with the actual solidification microstructures revealed by liquid-tin quenching. On the other hand, the parabolic growth model where solid-liquid interface advances in proportion to square root of time did not fit with the actual microstructure.

(3) Distributions of Ni and Cr in cellular dendrite calculated corresponded well to the EPMA results.

(4) It was concluded that the two dimensional modelling proposed in this reoprt was very useful to understand the weld solidification phenomena.

Key Words: Computation, Segregation, Solidification, Stainless steels, Microstructure, Austenite, Ferrite

<P.85>

Numerical Analysis on Solidification Brittleness Temperature Range in Stainless Steel

—Weld Crack Susceptibility of Duplex Stainless Steel (Report V)—

by Fukuhisa Matsuda*, Hiroji Nakagawa* and Jong-Bong Lee**

*Member, Welding Research Inst. Osaka Univ. **Student Member, Graduate Student of Osaka Univ. (Now with RIST. Republic of Korea)

Two dimensional modelling of the cellular dendritic growth during weld solidification was applied to the prediction of Solidification Brittleness Temperature Range (BTR) of several kinds of stainless steels. The calculation of BTR was done based on the observation that the lower temperature limit of BTR corresponded to the temperature at which residual liquid enriched with impurities solidified completely. This treatment gave a good agreement between the calculated and the experimental BTR for ferritic and fully austenitic stainless steel by paying attention to mesh size in the model. Moreover, the treatment was also useful to rank harmful elements in crack susceptibility. Then ,the modelling was applied to the prediction of the reason why duplex stainless steel had a relatively large BTR. As the results of this calculation, it was judged that nitrogen was very harmful element. This prediction was confirmed experimentally by making the tentative deposited metals containing low nitrogen.

Therefore, the calculation proposed was considered to be very useful to predict or analyze BTR for materials which solidified as single phase.

Key Words: Computation, Hot cracking, Solidification, Stainless steels, Nitrogen

<P.93>

Effects of Nitrogen and Molybdenum on Weld Solidification Crack Susceptibility

—Weld Crack Susceptibility of Duplex Stainless Steel (Report VI)—

by Fukuhisa Matsuda*, Hiroji Nakagawa*, Jong-Bong Lee** and Yasuhiro Nishio***

*Member, Welding Research Inst. Osaka Univ. **Student Member, Graduate Student of Osaka Univ. (Now with RIST. Republic of Korea)
***Member, Engineering Dep. Kinki Univ.

Weld solidification crack susceptibility and pitting corrosion resistance of tentative duplex stainless steels were investigated in order to decrease the crack susceptibility without decreasing the corrosion resistance in a duplex stainless steel. The results obtained are as follows:

(1) Crack susceptibility was improved with decreasing the N content in 22 to 25Cr–1 to 10Ni duplex stainless steels, but was not considerably changed with increasing the Mo content up to 4.5% at constant level of 0.03%N.

(2) Corrosion resistance was improved with increasing the Mo content at constant level of 0.03%N.

As a result, it was suggested that a lower N and Mo in the range of 4.0 to 4.5% were very effective for the development of a duplex stainless steel which had the low crack susceptibility without decreasing the corrosion resistance.

Key Words: Hot cracking, Corrosion resistant, Nitrogen, Stainless steels, Microstructure

<P.99>