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Effects of Alloying Elements on Liquid Zinc Embrittlement of HT590MPa Class Steel Plate

، (Tomoya Koseki) ج (Keniti Amano)

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Synopsis :

In the hot dip zinc galvanizing process of a high strength steel plate, a crack occurs at the weld heat affected zone due to liquid metal embrittlement (LME). The crack is

function of chemical composition of the steel plate. If the value of R i (ft=400) is larger than 40%, no LME crack occurs. It is confirmed that Zr suppresses the hardenability, decreases the formation of coarse precipitates at grain boundaries, and increases the binding energy of the grain boundary.

合金元素の影響*

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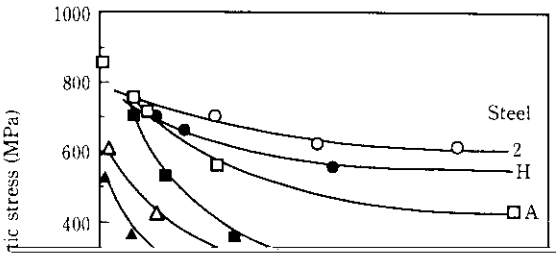
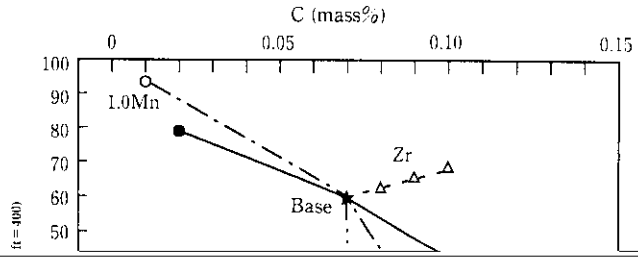
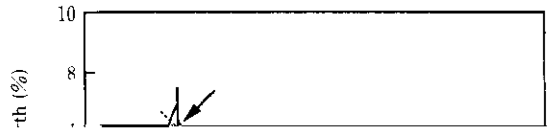
Table 1 Chemical compositions of steel studied

(mass%)

	C	Si	Mn	P	S	Nb	V	Cu	Ni	Cr	Mo	Ti	Zr	B
Range	0.02 ~	0.03 ~	1.00 ~	0.013 ~	0.002 ~	tr. ~	tr. ~	tr. ~	tr. ~	tr.	tr. ~	tr. ~	tr. ~	tr. ~
Base	0.07	0.25	1.60	0.016	0.002	0.035	0.045	—	—	—	—	—	—	—
2	0.02	0.25	1.60	0.016	0.002	0.035	0.045	—	—	—	—	—	—	—
4	0.07	0.03	1.60	0.016	0.002	0.035	0.045	—	—	—	—	—	—	—
9	0.07	0.25	1.60	0.016	0.002	0.035	0.045	—	—	—	0.20	—	—	—
12	0.07	0.25	1.60	0.016	0.002	0.035	0.045	0.20	—	—	—	—	—	—

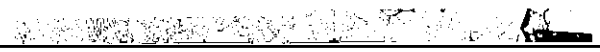

1000
800
600
400
tic stress (MPa)
Steel
2
H
A


C (mass%)
0
0.05
0.10
0.15
100
90
80
70
60
50
1.0Mn
Zr
Base


10
8
th (%)

$$\cos(\theta/2)=\gamma_b/2\gamma_{s\text{-}l}=\frac{760\times10^{-3}}{2\times185\times10^{-3}}\ \text{to}\ \frac{760\times10^{-3}}{2\times105\times10^{-3}}$$

Specimens test specimens



Increase in embrittlement caused by

界結合力が弱められ，引張応力の付加で容易にき裂が発生する。さらに，粒界近傍に粗大炭化物が存在したり，粒内が硬化して粒界へ