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KAWASAKI STEEL GIHO
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¹ X Ã ¬ Ò m j » Ì ~ 3 ¼ ± ? D J @ M _ \ ª p 0 n « U µ p

Impact Energy Absorbing Capabilities and Shape Fixabilities of High Strength Steel Sheets for Automotive Bodies

§ ¥ a Ð Ó Tetsuo Shimizu Ô ¤ º Ï x Ó Takaaki Hira Ô Ñ c ¢ ¦ Ó Eiji Iizuka Ô

¾ w :

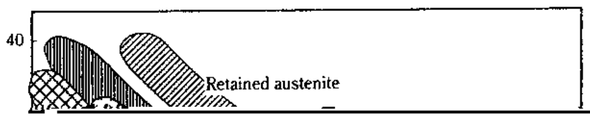
¹ X Ã 3 Ä Ê Y 0 · ¼ ± e T p ^ N 3 ¯ [* = ª p > O ² (+ = - 8 2 4 Ò m j Ì ~ 3 Æ ¬ $ { W / = r n È ` n « 2 Æ ) - Ò m j Ì ~ 3 } v ª p 3 Ç f Õ = ! 4 Ò m j Ì ~ 3 } v ª p 2 Æ ) - r n È ` n « 3 Ç f >] ¸ 0 * = ' 0 > ® - 0) . Õ È } 0) . 3 ¼ ± ? D J @ M _ \ ª p Õ " : 5 E K C r n y 3 n « U µ p 3 Q V Â S > FEM A G H K M A I L Á ³ 2 : < À) - , 3 µ ¡ Õ Ì ~ 3 Ò Å d n ª p > ¶ q) Õ È } 0) . 3 ¼ ± ? D J @ M _ \ ª p $ Â S / % = ' 0 > x ; # 0) - (; 2 Õ n « U µ p > P 0) . t É * = } v ª p 4 z & Z o 3 ¨ g 2 0 9 1 ! Î R m (# ; k l m (6 0 d Y * = ' 0 > x ° 2) -

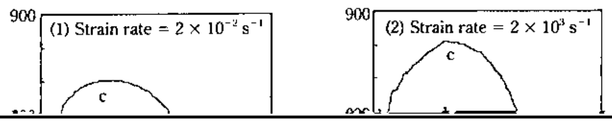
Synopsis :

In order to satisfy the requirements for the weight reduction and crashworthiness at the same time, the application of high strength steel sheets is effective for automotive body. The impact energy absorbing capability of a sheet metal to be formed as parts and the shape fixability after sheet metal forming were analyzed, previous to forming, through finite element method (FEM) simulation to clarify the selection of material characteristics of a high strength steel sheet suitable for forming parts, or the selection of the shapes of parts which are suitable for the material characteristics of a high strength steel sheet. As a result, it was found that in consideration of the rapid impact deformation behavior of a steel sheet, FEM simulation can evaluate the impact energy absorbing capability of a sheet metal as parts to be formed. Further, the material characteristic, which mainly controls the shape fixability after sheet metal forming, changes from yield strength to tensill 3 ( )]d2 (1 (al) 5bro) 1 (m) 8( ) 19(y) 2 (i) (e)2 (l) 2 (i 2 1 (s)2 (i 21 ( )

Table 1 The Japan Iron and Steel Federation standard and hardening mechanism of typical high tensile strength steel sheets produced by

TS grade (MPa)	JISF standard	Kawasaki Steel standard	Hardening mechanism
	JSH440W, J	SAPH440	C, Mn alloyed solid solution hardening


40
Retained austenite


900
(1) Strain rate = 2 × 10⁻² s⁻¹
c
900
(2) Strain rate = 2 × 10³ s⁻¹
c

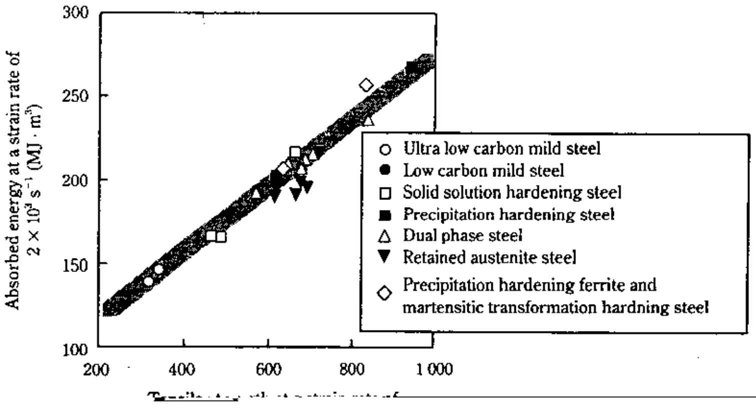
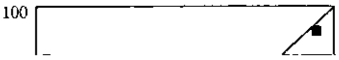
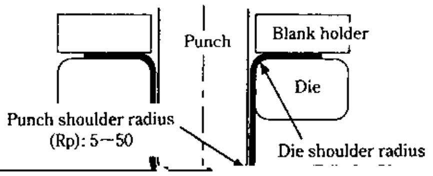
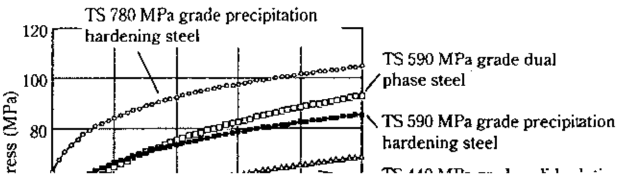


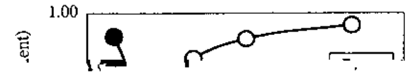
Fig. 4 Relationship between absorbed energy at a strain rate of 2×10^{-2} s^{-1} and tensile strength at a strain rate of 2×10^3 s^{-1}

Mild steel	590 MPa grade




Punch
Blank holder
Die
Punch shoulder radius
(Rp): 5～50
Die shoulder radius


TS 780 MPa grade precipitation hardening steel
TS 590 MPa grade dual phase steel
TS 590 MPa grade precipitation hardening steel
120
100
80
ress (MPa)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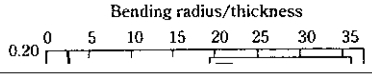
Bending radius/thickness
0
5
10
15
20
25
30
35
0.20