Abstract:

JFE Steel has developed two types of formable high-carbon steel sheets for automotive power train parts which are suitable for one-piece forming. The non-oriented high-carbon cold-rolled steel sheet has extremely low planar anisotropy of the r-value (Δr = 0.06), resulting in high formability, and excellent hardenability in low-temperature, short-time heat treatment. This new sheet displays high dimensional accuracy in press forming of cylindrical rotating parts. Hyper-burring high-carbon hot-rolled steel sheet (Hyper-Burring SC) has excellent burring properties (hole expansion, punching) due to fne dispersion of spheroidized cementites, which was made possible by applying a rapid cooling system (Super-OLAC H) in the run-out table of the hot-rolling process, and is an optimum product for thickness-addition forming.

1. Introduction

Qeb hbv fpprbp clo qb`ekf`^i absbilm j bkq fk qeb ªbia lc ^rql j lqfsb ml tbo qo^fk m^oqp clo pf j riq^kblrpiv p^qfp* cvfkd qeb obnrfob j bkqp lc il t crbi `lkpr j mqflk ^ka `lpq `l j mbqfqflk fk qeb dil_^i j ^ohbq fk`irab7 %.& f j molsba ml tbo qo^fk bcª`fbk`v %obar`ba olq^qflk^i obpfpq^k`b&) %/& tbfdeq obar`qflk tfqelrq p^`ofª`fkd efde aro^_fifqv) ^ka %O& f j molsba af j bkpflk^i ^``ro^`v ^ka obar`qflk lc bu`bpp j ^qbof^i fk m^oqp+ Ml tbo qo^fk m^oqp j rpq mlp* pbpp _lqe efde ^``ro^`v ^ka efde pqobkdqe) ^ka _b`^rpb qeb molar`qflk mol`bpp `lkpfpqp lc j ^kv fkafsfar^i mol* `bppbp pr`e ^p clo j fkd) tbiafkd) ^ka e^oabkfkd) mol* `bppfkd `lpqp ^``lrkq clo ^ i^odb mbo`bkq^db lc qeb qlq^i m^oq `lpq fk `l j m^ofplk tfqe j ^qbof^i `lpqp+ >rql j ^h*

oliiba pqbbi pebbq tef`e mlppbppbp _lqe qeb bppbkqf^i molmboqv lc mobpp clo j ^_fifqv ^ka efde fkar`qflk* e^oabk^_fifqv[4]

2.1 Development Concept

Mi^k^o ^kfplqolmv fk pqbbi pebbqp fp ab[a]kba _v qeb *r**s^irb %= xik%*w*_.*w*&z , xik%*t*_.*t*&z) tebob *w* fp tfaqe ^ka *t* fp qef`hkbpp&[5] Qeb abdobb lc b^oofkd arofkd `rm* clo j fkd lc ^ pqbbi pebbq ab`ob^pbp ^p qeb mi^k^o ^kfplq* olmv lc qeb *r*\*s^irb $\%\Delta r = \%r_{-þ} + r_{6-þ} - /r_{12þ}$&,/& ^mmol^`ebp -[5] Mi^k^o ^kfplqolmv fp pqolkdiv `loob* i^qba tfqe qeb ob`ovpq^iifw^qflk qbuqrob[5][1&]

qef`hkbpp ^``ro^`v+

Qeb j lpq `ofqf`^i molmboqv clo ml t bo qo^fk m^oqp fp `fo`ri^ofqv+ >p `^k _b pbbk fk **Fig. 3**) fk qeb `rm `vifkabo qbpq) qeb `lksbkqflk^i pqbbi pel t ba i^odb absf^qflkp fk lrqbo af^ j bqbo ^q ^ 12Þ mfq`e) `loobpmlkafkd ql qeb t ^ii ebfdeq ^ka qef`hkbpp ^aafqflk+ Fk `lkqo^pq) qeb absbilmba pqbbi t ^p sfoqr^iiv cobb lc absf^qflkp fk lrqbo af^ j bqbo lsbo qeb bkqfob 03-Þ `fo`r j cbobk`b+ %Qeb _olhbk ifkbp fk Cfd+ 0 pel t qorb `fo`ri^ofqv+& Qerp) qeb absbilmba pqbbi afpmi^vp bu`biibkq `fo`ri^ofqv ^cqbo ao^ t fkd) bif j * fk^qfkd qeb kbba clo ^ pe^mb obclo j fkd mol`bpp+ J lob* lsbo) _b`^rpb qeb absbilmba pqbbi ^ipl mlppbppbp efde bilkd^qflk) fq e^p bu`biibkq mobpp clo j ^_fifqv ^ka `^k _b

^mmifba ql qeb m^oqp t fqe `l j mibu pe^mbp+

2.3.3 Hardenability of developed steel

> e^oabk^_fifqv bs^ir^qflk t ^p mboclo j ba rpfkd .-- j j fk af^ j bqbo _i^khp ªkfpeba _v j ^`efkfkd qeb badbp+ T efib olq^qfkd qeb p^ j mibp ^q 4- om j) qeb lrqbo badb ℵ† p db dk db ŝ ℵ† p

dobppfsbiv ^almqba fk ob`bkq vb^op) _rq fk j ^kv `^pbp) il t*`^o_lk elq*oliiba pqbbi pebbqp t fqe efde clo j ^_fi* fqv ^ob rpba ^p qeb j ^qbof^i+ mfoj ^_fi*

fkd d^rdb obar`qflk %obar`qflk lc bu`bpp j ^qbof^i qef`h*
kbpp&+

Fq e^p ilkd _bbk hkl t k qe^q qeb elib*bum^kpflk molm*