1st International Conference

SUPER-HIGH STRENGTH STEELS

2-4 November 2005
Rome, Italy

abstracts

Organizzato da
Associazione Italiana di Metallurgia
Centro Sviluppo Materiali
INDEX

PLENARY SESSION

The international scenario for gas production and large transmission lines .......... 19
D. Brkic

Materials technology for advanced coal power plants ........................................... 20
R. Viswanathan, R. Purgert, U. Rao

The use of advanced high strength steel sheets in the automotive industry .......... 21
C. Federici, S. Maggi, S. Rigoni

The use of very high strength steels in metallic construction ................................. 22
G. Sedlacek, C. Müller

The European Steel Technology Platform - ESTEP .............................................. 23
J.C. Charbonnier, G. Buzzichelli

AUTOMOTIVE

STATE OF THE ART AND FUTURE TRENDS

Dual phase steels for auto body: design, forming and welding aspects ............... 27
B. Carlsson, J. Larsson, T. Nilsson

Mechanical and technological properties of ultra high strength optim steels ....... 28
H. Hemmilä, R. Laitinen, T. Liimatainen, D. Porter

Hot rolled high strength carbide-free 0.3%C bainitic steels ............................. 29
with improved toughness
S. Allain, A. Couturier, T. Iung, F.G. Caballero, M.J. Santofimia, C. Capdevila,
C. García de Andrés

Determination of input data for numerical design of sheet steels ......................... 30
A common research project of the steel and automotive industries
G. Steinbeck, W. Bleck, C.-P. Bork, T. Evertz, A. Frehn, R. Masendorf, C.M. Sonsino

A super-high strength Fe-Mn-C austenitic steel with excellent formability .......... 31
for automobile applications
P. Cugy, A. Hildenbrand, M. Bouzekri, D. Cornette, S. Göklü, H. Hofmann

High strength and ultra high strength hot rolled steel grades - products ........... 32
for advanced applications
H. Spindler, M. Klein, R. Rauch, A. Pichler, P. Stiaszny

Metallurgically based development of dual-phase thin hot strips ....................... 33
by Arvedi I.S.P. Technology
G. Porcu, M.C. Cesile, A. Guindani
FORMING - JOINING & MECHANICAL CHARACTERISATION

Keynote: Potential applications of new HSS grades for wheels .................. 37
A. Finzi, F. Valente

Prediction of forming limit of high-strength steel sheets .................... 38
H. Takuda, H. Fujimoto, T. Hama, T. Maruyama

Controlling galling in sheet metal forming of high strength steels: .......... 39
a numerical approach
E. Gelinck, E. van der Heide, M. de Rooij, D. Schipper

A comparison of yield loci measured with mechanical tests ................. 40
and calculated from crystal plasticity for steel sheets

Possibilities offered by MIG and TIG brazing of Galvanized ultra high .......... 41
strength steels for automotive applications
C. Chovet, S. Guiheux

Effect of YAG laser cutting on stretch-flangeability of 0.1-0.6%C ............ 42
trip steels
A. Nagasaka, A. Koyama, K. Sugimoto, T. Hojo T. Kashima

The application of high-alloyed steel in vehicle structures .................. 43
welding solutions
H. Herold, J. Pieschel, S. Jüttner

FEM evaluation of springback after sheet metal forming: ..................... 44
application to high strength steels of a combined
isotropic-kinematic hardening model
F. Campana, L. Cortese, F. Placidi

Determination of fatigue crack propagation limit curves ..................... 45
for high strength steels
J. Lukács

Techniques for improving the weldability of trip steel using ................. 46
resistance spot welding
G. Shi, S.A. Westgate

Crystallographic texture and mechanical properties ......................... 47
in high martensitic dual phase steels
S. Barella, R. Venturini, C. Mapelli

Local laser heat treatment of ultra high strength steels .................... 48
to improve formability
A. Weisheit, G. Vitri, K. Wissenbach, S. Scheffler

Resistance spot welding of advanced high strength steel DP600 ............ 49
S. Poggio, M. Ponte, C. Gambaro, J. Adamowski

Development of ductile martensitic tubes and its application ............. 50
in automotive parts
P. Shanmugam, K. Srinivas, M. Preethi, R. Natarajan

Potential application of stainless steel for vehicle crashworthiness structures .. 51
F. Placidi, S. Fraschetti
HIGH TEMPERATURE MATERIALS

PHYSICAL AND CREEP PROPERTIES

Keynote: Microstructural stability of strong 9-12 wt% Cr steels .................................. 55
H.K.D.H. Bhadeshia

Change in the system free energy of high Cr heat resistant steels .................................. 56
with annealing at elevated temperatures
Y. Murata, T. Kunieda, M. Nakai, M. Morinaga, T. Koyama

Structural stability of new creep-resistant steel grades with 9 ................................. 57
or 12% Cr contents applied in power generation sector
in industrial conditions
J. Pasternak, A. Kielbus

Creep resistant 9-12% Cr steels - long-term testing, microstructure ....................... 58
stability and development potentials
J. Hald

New creep rupture assessment of Grade 91 ......................................................... 59
L. Cipolla, J. Gabrel

Improvement in creep strength of advanced heat resistant steel ......................... 60
based ferrite matrix
Y. Toda, H. Kushima, K. Kimura, F. Abe

Microstructural stability and creep data assessment ..................................... 61
of Tenaris Grades 91 and 911
A. Di Gianfrancesco, L. Cipolla, F. Cirilli, G. Cumino, S. Caminada

BOILERS

Keynote: High performance creep resistant steels ........................................ 65
for 21st century power plants
F. Abe

Heat resisting steels of the new generation and examples ................................. 66
of their application in supercritical boilers designed
for the Polish power plants
J. Brózda, J. Pasternak

P23 and P24 for power generation and hydrogen service-are they fit ............. 67
for these applications? -
H. van Wortel

Development of creep resistant 9Cr-3W-3Co steel containing high boron .......... 68
for USC boilers
H. Semba, F. Abe

STEAM TURBINE

Keynote: Materials development for boilers and steam turbines operating .......... 71
at 700 °C
R. Blum, R.W. Vanstone
Manufacturing and mechanical & metallurgical properties ........................................... 72
of 9 ~ 12% Cr rotor forgings steel for advanced steam turbine

Cyclic fatigue characteristics of 10%Cr blade steels for advanced ................. 73
steam turbine
J-I. Suk, K-C. Kim, B-H. Kim, J-T. Kim

OXIDATION AND OPERATIONS

Investigations on oxidation and corrosion characteristics of the advanced ........ 77
boiler materials at steam temperatures up to 720°C
Q. Chen, G. Stamatelopoulos, A. Helmrich, S. Kjaer, C. Stolzenberger

The effects of extended operation parameters on X20CrMoV12.1 steel.......... 78
grade structural stability
A. Kielbus, K. Rodak, J. Pasternak

Analysis of effect of chemical composition on hot forming operations .......... 79
of P91 steel
S. Spigarelli, E. Evangelista, M. El Mehtedi, L. Balloni, A. Poli

WELDMENT

Keynote: Alloy design for similar and dissimilar welding and their behaviours .. 83
C. Jochum, H. Heuser

Fabrication and weldability of grade 23 tubing and piping ............................ 84
A. Poli, S. Caminada, C. Rosellini, A. Bertoni, G. Liberati

Carbon and nitrogen redistribution in weld joints of heat resistant steels ...... 85
J. Sopoušek, R. Foret

Low cycle fatigue behaviours of the welded joints of 9 to 12% Cr ferritic .... 86
heat resistant steels for boiler of fossil power plants

MISCELLANEOUS

New heat resistant alloys more over 700°C ......................................................... 89
S. Muneki, H. Okubo, F. Abe

Reliability of computer simulations for the design of a cost effective low .... 90
Ni heat resistant austenitic steel
O. Tassa, H. van Wortel, B. Bonnefois, E. Baune

Copper in super304H heat resistant steel ....................................................... 91
S.C. Cheng, Z.D. Liu, G. Yang, Y. Yang, L.M. Wang, X.J. Sun, H. Dong

Crack growth behaviour of P92 at temperatures above 500°C in different ...... 92
atmospheres
F. Schubert
STRUCTURAL APPLICATIONS

STRUCTURAL STEEL

Keynote: Light-weight design chances using high-strength steels ......................... 95
C.M. Sonsino

Structural applications of stainless steel .............................................................. 96
G. Abbruzzese, M. Barteri

Production and properties of high-strength nickel alloy steel plates .................... 97
for low temperature applications
K. Hickmann, A. Kern, U. Schriever, J. Stumpfe

Consumables for welding of (very) high strength steels - mechanical ................. 98
properties of weldments in as-welded and stress-relieved applications
E. Bauné, C. Chovet, B. Leduey, C. Bonnet, S. Starck, A. Bertoni

OCTG & DIVERSIFIED

Development of high strength quenched and tempered seamless pipes ............... 101

The design of X80 to X120 steels with increased carbonic acid corrosion .......... 102
resistance
D.V. Edmonds, R.C. Cochrane, R.M. Grau, J.P. Gonzalez, B. Kermani

Design criteria vs. line pipe requirements for offshore pipelines .................. 103
E. Torselletti, L. Vitalli, R. Bruschi

PIPELINE

Keynote: The TAP Project .................................................................................. 107
F. Marchesani, E. Donati, C.M. Spinelli, G. Mannucci, G. Demofonti,
M. Cabrini, T. Pastore

Keynote: High performance line-pipe steel in China ....................................... 108
Y-k. Wang, J-h. Pan

Development, production and application of heavy plates .......................... 109
in grades up to X120
F. Grimpe, S. Meimeth, C.J. Heckmann, A. Liessem, A. Gehrke

Effect of simulated thermomechanical processing on the transformation .......... 110
characteristics and microstructure of an API X80 pipeline steel
P. Cizek, B.P. Wynne, P.D. Hodgson, B.C. Muddle

Technological solutions for ultra-high strength gas pipelines ....................... 111
H.G. Hillenbrand, C. Kalwa, A. Liessem

Fracture resistance against internal pressure on high strength ................... 112
over X80 line pipe

Strain based design for land high grade pipelines in harsh environments .... 113
L. Vitali, E. Torselletti, F. Marchesani, R. Bruschi
Development of high strength linepipe with excellent deformability
M. Okatsu, N. Ishikawa, S. Endo, N. Suzuki

X100 - Fracture initiation and propagation
G. Mannucci, G. Demofonti, M. Di Biagio

X100 - Girth welding, joint properties and defect tolerance
M. Hudson, L. Di Vito, G. Demofonti, R. Aristotile, B. Andrews, S. Slater

Development of API X-80 grade electric resistance welding line pipe
with excellent low temperature toughness
H. Nakata, C. Kami, O. Shiotani, M. Matsushita, S. Kawamura

Fracture toughness evaluation of prestrained line pipe steels
N. Hagiwara, N. Fukuda

Development of new in-mill mechanical testing towards X100 assessment
for gas pipe
G. Perrin, M. Martinez, P. Odru, T.T. Luu, A. Pineau, B. Tanguy, J. Besson

CONSTRUCTION

Keynote: HS steels in tension structures
M. Majowiecki

Keynote: High strength steels for launching bridges structures
E. Maiorana, A. Miazzon

The development of ultrahigh strength wire
S. Hobson, J. Wilkinson, C. O'Connor, S. Sefton

High-strength steels in welded state for light-weight constructions
under high and variable stress peaks
H. Kaufmann, C.M. Sonsino, G. Demofonti, S. Riscifuli

Eurocode for high strength steel and applications in construction
B. Johansson, P. Collin

Recent developments in the use of quenched and self-tempered
hot rolled h-beams
L. Weber, L-G. Cajot

Properties of high strength steel S890 in dry and aqueous environments

Metallurgical design of high-strength bainitic steels
A. Saccocci, P. Folgarait, A. De Ro, B. Eisenkolb

PHYSICAL METALLURGY & ALLOY DESIGN

GRAIN REFINEMENT

Keynote: Ultra-steels: innovation of steel structures by materials evolution
K. Nagal

Keynote: Research activities on advanced steels in NERCAST
H. Dong, Y. Gan, Y. Weng
Keynote: Development of high strength and high performance steels at POSCO through HIPERS-21 Project
J-K. Choi

Keynote: Ultrafine grained steels by advanced thermomechanical processes and severe plastic deformations
I. Salvatori

Fabrication and tensile properties of ultrafine grained steels

The formation of ultrafine grained microstructure in a plain C-Mn steel
R. Song, D. Ponge, D. Raabe

Change of effective thickness of austenite grain during severe plastic deformation
D-W. Suh, C-S. Oh, S-J. Kim

Deformation induced ferrite transformation and grain refinement in low carbon steel
X. Sun, Q. Liu, H. Dong

Effect of shear strain on deformed microstructures of austenitic grains
T. Inoue, F. Yin, K. Nagai

Grain refinement and high precipitation hardening by combining microalloying and ultra fast cooling
C. Mesplont

Mechanical properties of an ultrafine grained C-Mn steel
R. Song, D. Ponge, D. Raabe

High strength and good ductility of bulk nanostructured meta-stable austenitic alloys
J-E. Jin, Y-K. Lee

Fracture toughness of the welded joint of new generation ultrafine weathering steel
H. Qiu, T. Nishimura, K. Hiraoka

Improvement of hydrogen embrittlement in a tempered martensitic steel through grain refinement using undissolubed cementite
Y. Kimura, K. Tsuzaki

STRUCTURE & PROPERTIES

Keynote: Innovation of conventional heat treatment and microstructural modification of steels by electromagnetic processing
Y. Zhang, X. Zhao, L. Zuo, C. Esling

Microstructure and strain distribution influence on failure properties in formable steel sheets
P. Olaru, G. Gottstein, A. Pineau

Optimizing the mechanical properties of tempered martensitic steels
A. Ardehali Barani, D. Ponge
Effect of vanadium and thermomechanical treatment on the properties of 55SiCr6
A. Ardehali Barani, L. Fel, P. Romano, D. Ponge

Effect of intergranular ferrite on hydrogen delayed fracture resistance of high strength boron-added steel
J.S. Kim, K-T. Park, D. Lee, C.S. Lee

Solidification structure and properties of Nb-V microalloyed steels
G. Cumino, A. Mannucci, M. Vedani, J.C. Gonzalez

The influence of austenite on the toughness of martensitic steels
J.W. Morris Jr.

Mechanical properties improvement of Fe-Ni-Mn-Ti steel by alloying with Cr and Mo
M. Nili-Ahmadabadi, M. Sadeghi, H. Shirazi, S. Hossein Nedjad

High strength, toughness and nanostructure considerations for Fe/Cr/Mn/C lath martensitic steels
G. Kusinski, G. Thomas

Influence of tempering temperature on mechanical properties of ultra-high strength low-alloy steels
J. Hornikova, P. Sandera, J. Pokluda

Fractal nature of acicular ferrite, and fine precipitation in medium carbon micro-alloyed forging steels
R. Villegas, A. Redjaimia, M. Confenté, M.T. Perrot-Simonetta

ALLOY DESIGN

Keynote: Steel research at the University of California Berkeley: a historical perspective
J.W. Morris Jr., G. Thomas

Microstructural features of a new martensitic steel heat treatment: quenching and partitioning
D.V. Edmonds, K. He, F.C. Rizzo, A. Clarke, D.K. Matlock, J.G. Speer

The role of niobium in low carbon bainitic HSLA steel
K. Hulka

Quantitative evaluation of the microstructure in an Fe-Cr-C ternary martensitic steel with the aid of the system free energy concept
T. Kunieda, Y. Murata, M. Morinaga, M. Nakai, T. Koyama

Effect of Nb in solid solution on the austenite decomposition kinetic of a V-Nb-Ti microalloyed steel
M. Buhler, G.R. Gomez, T. Perez

Acceleration of graphitisation in carbon steels to improve machinability
D.V. Edmonds, K. He

Stainless austenitic steel of superior strength
H. Berns, V. Gavriljuk
Influence of deformation and molybdenum content on acicular ferrite .......................... 170
formation in medium carbon steels
C. Capdevila, J.P. Ferrer, F.G. Caballero, C. García de Andrés

The effect of chemical composition on the hot-deformation ................................. 171
resistance during hot strip rolling of microalloyed steels processed
at the Sidor hot strip mill
F. Siciliano, O. Marini, R.G. Bruna

The development of Nb-V microalloyed steel plate.............................................. 172
Y. Feng

Very strong bainitic steels ...................................................................................... 173
F.G. Caballero, C. García-Mateo, H.K.D.H. Bhadeshia

MODELING

Design by Fe analysis of a pressure vessel made..................................................... 177
of duplex stainless steel
M. Veljkovic, J. Gozzi

Thermodynamic modelling to support production of high nitrogen steels ........ 178
by different processes
F. Ruffini, O. Tassa, A. Carosi, F. Arcobello, B. Giambi

Simulation of diffusional processes during solidification in austenitic steels .... 179
D. Baldissin, L. Battezzati, M.R. Ridolfi, O. Tassa

CORROSION AND SURFACE PROTECTION

Coating technology of high strength steels without hydrogen embrittlement .. 183
W. Paatsch, V.-D. Hodoroba

PVD coating of steel strips ..................................................................................... 184
C. Metzner, B. Scheffel, F-H. Roegner

ADVANCED FABRICATION PROCESSES

Production and application of high strength steel ................................................. 187
Y. Feng

Direct Strip Casting (DSC) - an option for the production .............................. 188
of HSD® steel grades
M. Schäperkötter, H. Eichholz, J. Kroos, M. Niemeyer,
R. Schmidt-Jürgensen, K.-H. Spitzer
WELDING

Toughness of HRC 33/44 tool steels weldments ........................................... 191
with yield strength 1100 MPa
C. Larsson, P. Hansson, P. Kihlmark

Influence of chemical composition of weld metal on the properties .......... 192
of welded joint of high strength steels
Z. Huang, K. Miao, L. Hu

Laser beam welding of quenched and tempered ASTM A 517 Gr.B steel .......... 193
S. Missori, G. Costanza, E. Tata, A. Sili

Comparison of fatigue properties of welded TMCP steel .......................... 194
and normalized steel

New alloying concepts for high strength steel weld metals ....................... 195
E. Keehan, L. Karlsson

Local mechanical and microstructural characterization .............................. 196
of electron beam welded 15-5PH stainless steel
E. Herny, J.M. Cloue, S. Perusin, E. Andrieu, P. Lours, E. Jourdain, P. Lagain