



Dr. Sommer

MATERIALS TECHNOLOGY

Application Institute
for the Optimisation
of Material, Process and
Heat Treatment Applications

Material data sheet:

4140

Printed at: 16.09.2010



Activity field SoDat

Technical questions:

Dipl.-Verw.-wirt. Klaus-Peter Eschert

Dr. Sommer Werkstofftechnik GmbH
Hellenthalstr. 2 - D-47661 Issum
Tel. +49 2835 9606-0 - Fax. +49 2835 9606-60
Email: info@werkstofftechnik.com
<http://www.werkstofftechnik.com>

Mat.-No.:
 Material: 4140
 Country: USA (USA)
 Material group: Heat-treatable steels, Steels for cold extrusion, cast steel

Source: AISI
 Title: American Iron and Steel Institute

Analysis as AISI

C: 0,38 - 0,43 % Cu: max. 0,35 %
 Si: 0,15 - 0,35 %
 Mn: 0,75 - 1,00 %
 P: max. 0,025 %
 S: max. 0,025 %
 Cr: 0,80 - 1,10 %
 Mo: 0,15 - 0,25 %
 Ni: max. 0,25 %

Alloying base: Fe

Reference materials

Material:	Mat.-No.:	Source:	Status:
42CrMo4	1.7225	DIN EN 10083-3:2007-01 (D)	
42CrMo4	1.7225	DIN EN 10132-3:2000-05 (D)	
42CrMo4	1.7225	DIN EN 10250-3:1999-12 (D)	
42CrMo4	1.7225	DIN EN 10263-4:2002-02 (D)	
42CrMo4	1.7225	DIN EN 10263-4:2002-02 (D)	
42CrMo4	1.7225	DIN EN 10269:2006-07 (D)	
42CrMo4	1.7225	DIN EN 10297-1:2003-06 (D)	
42CrMo4	1.7225	DIN EN 10305-1:2010-05 (D)	
42CrMo4	1.7225	DIN EN 10343:2009-07 (D)	
42CrMo4	1.7225	SEL (D)	
40CD4		AFNOR (nicht genormte Stähle) (F)	
42CD4		AFNOR A 35-556:1984-10 (F)	
42CD4		AFNOR A 35-557:1983-07 (F)	
42CD4		AFNOR A 36-102:1993-09 (F)	
42CrMo4RR		AFNOR A 36-102:1993-09 (F)	
4140		AISI (USA)	
B7		ASTM A 193/A 193M:2007 (USA)	
4140		ASTM A 29/A 29M:2005 (USA)	
4140H		ASTM A 304:2005 (USA)	
4142H		ASTM A 304:2005 (USA)	
4140		ASTM A 322/b:2006 (USA)	
4140		ASTM A 505:2000 (USA)	
4140		ASTM A 513:2007 (USA)	
4140		ASTM A 519:2006 (USA)	
4142		ASTM A 519:2006 (USA)	
4140		ASTM A 711:2004 (USA)	

42CrMo4		BS 970-1:1996 (GB)
708M40		BS 970-1:1996 (GB)
709M40		BS 970-1:1996 (GB)
42CrMo		GB 3077:1999 (VC)
ML42CrMo		GB 6478:2001 (VC)
42CrMo		GB 8162:1999 (VC)
ZG42CrMo		GB JB/ZQ 4297:1986 (VC)
42CrMo		GB T 3078:1994 (VC)
SCM440M		JIS G 3311:1998 (J)
SCM440TK		JIS G 3441:1988 (J)
SCM440H		JIS G 4052:1979 (J)
SCM440		JIS G 4105:1979 (J)
SNB7Class2		JIS G 4107:1994 (J)
C4732		JUS C.B9.021:1989 (SCG)
4140		MIL-S-16974 (USA)
4140		MIL-S-46059 (USA)
4140		MIL-S-5626 (USA)
4140H		SAE J 1268:1995 (USA)
4142H		SAE J 1268:1995 (USA)
4140RH		SAE J 1868:1993 (USA)
4140		SAE J 404:2000 (USA)
42CrMo4	1.7225	SEW 550:1976-08 (D)
2244		SS (S)
41MoCr11AS		STAS/SR 11290-89 (RO)
42MoCr11		STAS/SR 791-88 (RO)
41MoCr11		STAS/SR 8185-88 (RO)
42MoCr11q		STAS/SR 9382/4-89 (RO)
42CrMo4		UNE 36254:1979 (E)
F.8232		UNE 36254:1979 (E)
AM42CrMo4		UNE 36255:1979 (E)
F.8332		UNE 36255:1979 (E)
G40CrMo4		UNI 3160:1983 (I)
42CrMo4		UNI 6403:1986 (I)
38CRM04KB		UNI 7356:1974 (I)
G41400		UNS (USA)
H41400		UNS (USA)
H41420		UNS (USA)
K14248		UNS (USA)
4140H		SAE J 775:2004 (USA)
NV7		SAE J 775:2004 (USA)
42CrMo4		Fundia (S)
42CrMo4		Imatra (FIN)
42CrMo4	1.7225	Deutsche Edelstahlwerke (D)
42CrMo4	1.7225	Georgsmarienhütte (D)
42CrMo4	1.7225	Saarstahl (D)
42CrMo4	1.7225	Schmidt+Clemens (D)
42CrMo4	1.7225	Eschmann-Stahl (D)
42CrMo4	1.7225	Höver&Sohn (D)
42CrMo4	1.7225	Platestahl (D)
42CrMo4	1.7225	HKM Krupp Mannesmann (D)
42CrMo4	1.7225	AG der Dillinger Hüttenwerke (D)
42CrMo4	1.7225	Dirostahl (D)

42CrMo4	1.7225	Zapp (D)	
42CrMo4	1.7225	Buderus (D)	
DIRO-42CrMo4	1.7225	Dirostahl (D)	
M.O.C.3J		Aubert & Duval (F)	
M.O.C2		Aubert & Duval (F)	
RO952	1.7225	BOFORS (S)	
V320	1.7225	Böhler Uddeholm (A)	
VCMo140	1.7225	Grimm Edelstahl (D)	
W3-223	1.7225	BOFORS (S)	
W3-2244	1.7225	BOFORS (S)	
42CrMo4	1.7225	DIN EN 10083-1:1996-10 (D)	Invalid
42CrMo4	1.7225	DIN EN 10269:1999-11 (D)	Invalid
42CrMo4	1.7225	DIN EN 10305-1:2003-02 (D)	Invalid
42CrMo4	1.7225	DIN 1652-4:1990-11 (D)	Invalid
42CrMo4	1.7225	DIN 1654-4:1989-10 (D)	Invalid
42CrMo4	1.7225	DIN 17204:1990-11 (D)	Invalid
G42CrMo4	1.7225	DIN 17205:1992-04 (D)	Invalid
GS-42 CrMo 4	1.7225	DIN 17205:1992-04 (D)	Invalid
42CD4		AFNOR A 35-552-1 (F)	Invalid
42CD4		AFNOR A 35-553 (F)	Invalid
42CD4		AFNOR A 35-554 (F)	Invalid
42CD4	1.7225	AFNOR EN 10083-1:1997-02 (F)	Invalid
42CrMo4	1.7225	AFNOR EN 10269:1999-11 (F)	Invalid
4140		ASTM A 331 (USA)	Invalid
4140		ASTM A 547 (USA)	Invalid
4140		ASTM A 646 (USA)	Invalid
708M40		BS 970-3:1991 (GB)	Invalid
709M40		BS 970-3:1991 (GB)	Invalid
42CrMo4	1.7225	BS EN 10083-1:1991 (GB)	Invalid
42CrMo4	1.7225	UNE EN 10083-1:1997 (E)	Invalid
42CrMo4	1.7225	UNI EN 10083-1:1998 (I)	Invalid
42CrMo4	1.7225	DDR-TGL (D)	Invalid
GS-42CrMo4	1.7225	DDR-TGL (D)	Invalid
1.7225	1.7225	Höverstahl (D)	Invalid
42CrMo4	1.7225	Krupp (D)	Invalid
BSH	1.7225	DEW (D)	Invalid
Mo40	1.7225	Röchling (D)	Invalid
V320	1.7225	VEW (D)	Invalid

Material data sheet

Heat Treatment Database

Material

Short name:	42CrMo4	Mat.-No.:	1.7225
Source:	DIN EN 10083-3:2007-01		
Title:	Steels for quenching and tempering - Part 3: Technical delivery conditions for alloy steels		

Material group

Heat-treatable steels, Steels for cold extrusion, cast steel

Chemical composition (in weight %)

Element	C	Si	Mn	P	S	Cr	Mo				
min	0,38	max.	0,60	max.	max.	0,90	0,15				
max	0,45	0,40	0,90	0,025	0,035	1,20	0,30				

Hot forming and heat treatment

Hot forming:	1100 -850 °C
Normalising:	840 -880 °C
Soft annealing:	680 -720 °C
Hardening:	820 -880 °C -> Oil or water
Tempering:	540 -680 °C min. 60 min. (approx.)

Mechanical properties

Delivery condition	Quenched and tempered (+QT)				
Diameter d [mm]	<=16	16<d <=40	40<d <=100	100<d <=160	160<d <=250
Thickness t [mm]	<=8	8<t <=20	20<t <=60	60<t <=100	100<t <=160
Proof stress R _e [MPa]	min. 900	min. 750	min. 650	min. 550	min. 500
Tensile Strength R _m [MPa]	1100 - 1300	1000 - 1200	900 - 1100	800 - 950	750 - 900
Elongation after fracture A [%]	min. 10	min. 11	min. 12	min. 13	min. 14
Reduction of area Z [%]	min. 40	min. 45	min. 50	min. 50	min. 55
Notch impact energy ISO-V [J]	-	min. 35	min. 35	min. 35	min. 35
Delivery condition	Treated suitable shearing (+S)		Soft annealed (+A)		
Hardness [HBW]	max. 255 ¹⁾		max. 241		
	1) In dependency on chemical composition soft annealing could be necessary by +HH classification.				
	Flame- or induction hardening				
Surface hardness [HRC] transverse section <=100 mm	max. 53				

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Material data sheet

Heat Treatment Database

Material

Short name:	42CrMo4	Mat.-No.:	1.7225
Source:	DIN EN 10297-1:2003-06		
Title:	Seamless circular steel tubes for mechanical and general engineering purposes - Technical delivery conditions - Part 1: Non-alloy and alloy steel tubes		

Material group

Heat-treatable steels, Steels for cold extrusion, cast steel

Chemical composition (in weight %)

Element	C	Si	Mn	P	S	Cr	Mo				
min	0,38	max.	0,60	max.	max.	0,90	0,15				
max	0,45	0,40	0,90	0,035	0,035	1,20	0,30				

Hot forming and Heat treatment

Hot forming:	1100 -850 °C
Normalizing:	840 -880 °C (normalizing before quenching and tempering)
Annealing:	680 -720 °C
Hardening:	820 -860 °C -> water or oil (+10°C)
Tempering:	540 -680 °C

Mechanical properties

Delivery condition	Quenched and tempered (+QT)			
T [mm]	<=8	>8 up to 20	>20 up to 50	>50 up to 80
Proof stress R _{eH} [MPa]	min. 900	min. 750	min. 650	min. 550
Tensile strength R _m [MPa]	min. 1100	min. 1000	min. 900	min. 800
Elongation after fracture longitudinal A [%]	min. 10	min. 11	min. 12	min. 13
Elongation after fracture transverse A [%]	min. 8	min. 9	min. 10	min. 11
	T<=8	8<T<=20	20<T<=60	60<T<=100
Impact value longitudinal at 20°C KV [J]	min. 30	min. 35	min. 35	min. 35
Impact value transverse KV at 20°C [J]	-	min. 22	min. 22	min. 22
Delivery condition	Soft annealed (+A)			
Brinell-Hardness	max. 241			

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Material data sheet

Heat Treatment Database

Material

Short name:	42CrMo4	Mat.-No.:	1.7225
Source:	DIN EN 10269:2006-07		
Title:	Steels and nickel alloys for fasteners with specified elevated and/or low temperature properties.		

Material group

Heat-treatable steels, Steels for cold extrusion, cast steel

Chemical composition (in weight %)

Element	C	Si	Mn	P	S	Cr	Mo				
min	0,38	max.	0,60	max.	max.	0,90	0,15				
max	0,45	0,40	0,90	0,025	0,035	1,20	0,30				

Hot forming and heat treatment

Hot working:	1100 - 850 °C
Soft annealing:	680 -710 °C
Hardening:	820 -860 °C -> oil, water
Tempering:	540 -680 °C

Mechanical properties

Condition	Treated to improve shearability (+S)	Soft annealed (+A)	Annealed to achieve spheroidization of the carbides (+AC)	Quenched and tempered (+QT)
Thickness [mm]				d <= 60
Hardness [HB]	255	241		
Proof stress R _{p0,2} [MPa]		-	max. 630	min. 730
Tensile Strength R _m [MPa]		-	-	860 - 1060
Elongation at fracture A ₅ [%]		-	-	min. 14
Reduction of area Z [%]		-	min. 57	min. 50
Impact value (ISO-V) KV [J]		-	-	min. 50
Impact value - longitudinal - at low temperature (ISO-V) [J] min.				
Temperature [°C]	-100	-40	0	+20
Heat treatment condition +QT Thickness d<=60 mm	27	40		50

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Material data sheet

Heat Treatment Database

Material			
Short name:	42CrMo4	Mat.-No.:	1.7225
Source:	DIN EN 10263-4:2002-02		
Title:	Steel rod, bars and wire for cold heading and cold extrusion - Part 4: Technical delivery conditions for steels for quenching and tempering		
Material group			
Heat-treatable steels, Steels for cold extrusion, cast steel			

Chemical composition (in weight %)	
not documented	

Hot forming and heat treatment	
Normalizing:	840 - 880 °C
Soft annealing:	680 - 720°C
Hardening:	820 - 860°C -> water, oil
Tempering:	540 - 680°C

Mechanical properties		
Delivery condition	Annealed to achieve spheroidization of the carbides (+AC) or annealed to achieve spheroidization of the carbides + peeled (+AC+PE)	
Product	Steel rod, bars	
Thickness [mm]	<=5	>5 - 40
Tensile strength R _m [MPa]	-	max. 630
Reduction of area Z [%]	-	min. 58
Delivery condition	Annealed to achieve spheroidization of the carbides + cold drawn + annealed to achieve spheroidization of the carbides (+AC+C+AC)	
Product	Bars, wire	
Thickness [mm]	<=5	>5 - 40
Tensile strength R _m [MPa]	max. 620	max. 610
Reduction of area Z [%]	min. 60	min. 60
Delivery condition	Annealed to achieve spheroidization of the carbides + cold drawn + annealed to achieve spheroidization of the carbides + skin passed (+AC+C+AC+LC)	
Product	Bars, wire	
Thickness [mm]	<=5	>5 - 40
Tensile strength R _m [MPa]	max. 660	max. 650
Reduction of area Z [%]	min. 58	min. 58

Material data sheet

Heat Treatment Database

Material

Short name:	42CrMo4	Mat.-No.:	1.7225
Source:	DIN EN 10263-4:2002-02		
Title:	Steel rod, bars and wire for cold heading and cold extrusion - Part 4: Technical delivery conditions for steels for quenching and tempering		

Material group

Heat-treatable steels, Steels for cold extrusion, cast steel

Max. diameter to get 90 % martensite in core hardness test (+CH)

Hardening temperature (austenitizing time min. 30 minutes)	845 - 855 °C
Core hardness [HRC]	50
Max. diameter [mm]	21

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Material data sheet

Heat Treatment Database

Material

Short name:	42CrMo4	Mat.-No.:	1.7225
Source:	DIN EN 10132-3:2000-05		
Title:	Cold-rolled narrow steel strip for heat-treatment. Steels for quenching and tempering.		

Material group

Heat-treatable steels, Steels for cold extrusion, cast steel

Chemical composition (in weight %)

Element	C	Si	Mn	P	S	Cr	Mo				
min	0,38	max.	0,60	max.	max.	0,90	0,15				
max	0,45	0,40	0,90	0,035	0,035	1,20	0,30				

Hot forming and heat treatment

Hot forming:	1100 -850°C
Normalising:	840 -880°C
Soft annealing:	680 -710°C
Hardening:	840 -870°C -> oil min. 51 HRC

Mechanical properties

Delivery condition	Soft annealed (+A) or soft annealed and slightly rerolled (+LC)	Cold rolled (+CR)	Quenched and tempered (+QT)
Thickness [mm]	0,30 <= t <=3,00	0,30 <= t <=3,00	0,30 <= t <=3,00
0,2%-Proof stress R _{p0,2} [N/mm ²]	max. 480	-	-
Tensile strength R _m [N/mm ²]	max. 620	by agreement	1020 - 1500
Elongation after fracture A ₈₀ [%]	min. 15	-	-
Hardness [HV]	max. 195	by agreement	315 - 465
Hardness	max. 90 HRB	-	35,0 - 48,5 HRC

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Material data sheet

Heat Treatment Database

Material

Short name:	42CrMo4	Mat.-No.:	1.7225
Source:	SEW 550:1976-08		
Title:	Steels for larger forgings.		

Material group

Heat-treatable steels, Steels for cold extrusion, cast steel

Chemical composition (in weight %)

Element	C	Si	Mn	P	S	Cr	Mo	Ni			
min	0,38	max.	0,50	max.	max.	0,90	0,15	max.			
max	0,45	0,40	0,80	0,035	0,035	1,20	0,30	0,60			

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Material data sheet

Heat Treatment Database

Material

Short name:	42CrMo4	Mat.-No.:	1.7225
Source:	DIN EN 10305-1:2010-05		
Title:	Steel tubes for precision applications - Technical delivery conditions - Part 1: Seamless cold drawn tubes		

Material group

Heat-treatable steels, Steels for cold extrusion, cast steel

Chemical composition (in weight %)

Element	C	Si	Mn	P	S	Cr	Mo				
min	0,38	max.	0,60	max.	max.	0,90	0,15				
max	0,45	0,40	0,90	0,035	0,035	1,20	0,30				

Usage

Seamless cold drawn tubes for engine building industry and general technical application

Mechanical properties

Delivery condition	Bright drawn / hard +C	Bright drawn / soft +LC	Bright drawn and stress relieving annealed +SR	Annealed +A	Normalized +N
Upper yield stress R_{eH} [MPa] min.	-	-	-	-	-
Tensile strength R_m [MPa] min.	720	670	-	-	-
Elongation after fracture A [%] min.	4	6	-	-	-

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Material data sheet

Heat Treatment Database

Material

Short name:	42CrMo4	Mat.-No.:	1.7225
Source:	DIN EN 10250-3:1999-12		
Title:	Open die steel forgings for general engineering purposes. Alloy special steels.		

Material group

Heat-treatable steels, Steels for cold extrusion, cast steel

Chemical composition (in weight %)

Element	C	Si	Mn	P	S	Cr	Mo				
min	0,38	max.	0,60	max.	max.	0,90	0,15				
max	0,45	0,40	0,90	0,035	0,035	1,20	0,30				

Usage

Open die steel forgings for general engineering purposes

Hot forming and heat treatment

Hardening:	820 - 860 °C -> oil or water
Tempering:	540 - 680 °C

Mechanical properties

Products	Open die forgings, forging bars		
Delivery conditions	Quenched and tempered (+QT)		
Thickness of the relevant section [mm]	$t_R \leq 160$	$160 < t_R \leq 330$	$330 < t_R \leq 500$
Upper yield stress R_e [N/mm ²] min.	500	460	390
Tensile strength R_m [N/mm ²] min.	750	700	600
Elongation after fracture A			
Longitudinal [%] min.	14	15	16
Transverse [%] min.	10	11	12
Impact value (V notched specimens) at 20°C			
Longitudinal [J] min.	30	27	22
Transverse [J] min.	16	14	12

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Heat treatment jobs for Heat-treatable steels

Heat Treatment Database

Material

Short name: 4140

Mat.-No.:

Hot forming treatments

1.	Hot forming	1100 - 850°C	Air cooling
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Annealing treatments

1.	Normalizing	840 - 850°C	Cooling in air
2.	Soft annealing	680 - 720°C	min. 4 - 6 h soaking time and air cooling
3.	Spheroidising	700 - 750°C	16 - 24 h soaking time and slow cooling
4.	Intermediate annealing	-	not usual at this steel
5.	Stress relieving	650 - 680°C	only for softly conditions
6.	Recrystallisation annealing	550 - 600°C	after cold working
7.	Coarse grain annealing	-	not usual at this steel
8.	Diffusion annealing	1200 - 1250°C	only in special cases before hot forming
9.	Solution annealing	-	not possible at this steel

Neutral hardening treatments

1.	Blank hardening	-	not usual at this steel
2.	Hardening	820 - 880°C	Quenching in oil, polymer, salt 180°C
3.	Tempering	540 - 680°C	min. 60 min soaking time at temperature
4.	Bainitic hardening	840 - 860°C	400 - 450°C transformation temperature
5.	Jominy test	845 - 855°C	Austenitizing time min. 30 min.
6.	Induction hardening	840 - 880°C	Quenching in polymer

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