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Material Properties Database and Estimation Tools

Material search results - DETAILED REPORT

GENERAL INFORMATION

RECORD INFORMATION

Material ID:	90		
Contributed by:	MATDAT	**Entry date:**	01.06.2011
Source:	Boller, C., Seeger, T.: Materials data for cyclic loading, Part A, Elsevier, Amsterdam 1987.		
Other reference(s):	Reik, W., Mayr, P., Macherauch, E.: Untersuchungen zum Schwingfestigkeitsverhalten von Ck 45, EGKS research program, final report, part B, 1979		

MATERIAL INFORMATION

Material designation:	**DIN**	**W.Nr. (DIN 17007)**	**EN**
	Ck 45	**1.1191**	
	AISI	**AFNOR**	**ASTM**
	1042 ; 1045	*XC45 ; XC48H1*	
	BS	**GOST**	**HRN**
	060A47 ; 080M46	*45*	
	ISO	**JIS**	**JUS**
	C45E4 ; CS45	*S 45 C*	*Č1531*
	SAE	**SS**	**UNS**
	1042 ; 1045	*1672*	*G10420 ; G10450*
	Other&Commercial		
	ACRONI JESENICE	**JEKLO-LIVARNA RAVNE**	**METAL RAVNE**
	C45E ; Č1531		*CK45*
	JEKLO ŠTORE	**VALJI ŠTORE**	
	CK45		
Designation additional remarks			
Material group	Unalloyed steel	**Steel subgroup**	
Typical application	*Comp. parts for vehicles-shafts, bushings, crankshafts, connecting rods and parts for the machine building industry. Steel to produce sickles, axes, knives, hammers.*		

TESTED MATERIAL

Chemical composition, (%)	**C**	**Si**	**Mn**	**P**	**S**	**Cr**
	0.48000	0.28000	0.77000	0.02100	0.03300	0.18000
	Mo	**Ni**	**Cu**	**Al**	**Co**	**Ti**
	0.03000	0.07000				
	W	**V**	**Nb**	**N**		
		0.02000				
	Other					
Semifinished material (source)	bar, diameter 20 mm					
Heat treatment	annealed					

Additional remarks:	870°C/30min/close annealed	
Microstructure		
Microstructure images		
Additional remarks:	grain size of ferrite ~6 micrometers	
Hardness	**Value(s)**	**Method**
Brinell		
Vickers		
Rockwell		
Mohs		
Knoop		
Additional remarks:		

TESTING CONDITIONS - GENERAL

Testing temperature, T (°C)	23
Testing medium	air

MONOTONIC TESTING

MONOTONIC (STATIC) TESTING - SPECIMEN(S) - STRESS-STRAIN CURVE(S)

	Specimen(s)	Monotonic stress-strain curve(s)	Other

MONOTONIC (STATIC) PROPERTIES - AXIAL LOADING

Testing conditions			
Loading type:	axial		
Loading control:			
Specimen:	cylindrical, diameter 3,8 mm ; location/orientation: in and diametral to rolling direction ; gauge length: 60 mm		
Aditional remarks:	testing machine: NA ; strain rate: 1,8 %/min ; Young's modulus estimated		
Young's modulus, E (Nmm^{-2})	210000		
Yield strength (conventional), R_e or $R_{p0,2}$ (Nmm^{-2})	415.0		
Ultimate tensile strength, R_m (Nmm^{-2})	680.0		
Elongation related to 5x diameter of specimen, A_5 (%)	19.0		
Reduction of area at fracture, Z (RA) (%)			
Poisson's ratio, ν			
Strength coefficient, K (Nmm^{-2})	413.0		
Strain hardening exponent, n	0.0010		
True fracture stress, σ_f (Nmm^{-2})			
True fracture strain, ε_f			

MONOTONIC (STATIC) PROPERTIES - TORSIONAL LOADING

Testing conditions			
Loading type:			
Loading control:			
Specimen:			
Aditional remarks:			
Shear modulus, G (Nmm^{-2})			
Shear yield strength, (Nmm^{-2})			
Ultimate shear strength, (Nmm^{-2})			
Shear strength coefficient, (Nmm^{-2})			
Shear strain hardening exponent			

CYCLIC/FATIGUE TESTING

CYCLIC TESTING - SPECIMEN(S) - STRESS-STRAIN CURVE(S) - STRESS-LIFE / STRAIN-LIFE CURVE(S)

	Specimen(s)	Cyclic stress-strain curve(s)	Stress-life / strain-life curve(s)	Other

CYCLIC / FATIGUE PROPERTIES - AXIAL LOADING, FULLY REVERSED, R=-1

Testing conditions			
Loading type:	axial		
Loading control:	total strain control		
Loading ratio:	-1		
Specimen:	cylindrical, diameter 10 mm ; surface: grinded, roughness 1 micrometer ; location/orientation: in and diametral to rolling direction ; gauge length: 25 mm		
Aditional remarks:	testing machine: Schenck, servohydraulic, 60 kN ; load frequency: 4-8 Hz ; strain rate: NA ; waveform: triangular ; failure criterion: macroscopical crack initiation ; no significant influence of test results for specimen location in or diametral to rolli		
Cyclic yield strength, $R'_{p0,2}$ (Nmm^{-2})		350.0	
Transition life, N_T		9082	
Calculated transition life (cycles)			
Cyclic strength coefficient, K' (Nmm^{-2})		808.0	
Cyclic strain hardening exponent, n'		0.1350	
Fatigue strength coefficient, σ'_f (Nmm^{-2})		2621.0	
Fatigue ductility coefficient, ε'_f		46593.0000	
Fatigue strength exponent, b		-0.2100	
Fatigue ductility exponent, c		-1.7529	
Stress amplitude at the number of cycles N_E (endurance/fatigue limit), σ_E (Nmm^{-2})	**10%**	**50%**	**90%**
Strain amplitude at the number of cycles N_E (endurance/fatigue limit), ε_E	**10%**	**50%**	**90%**

Exponent of *S-N* curve			
Number of cycles corresponding to the endurance/fatigue limit, N_E			
10/90 scatter band for stress amplitudes, T_σ	1.195		
10/90 scatter band for plastic strain amplitudes, $T_{\varepsilon p}$	6.424		

CYCLIC / FATIGUE PROPERTIES - TORSIONAL LOADING, FULLY REVERSED, R=-1

Testing conditions			
Loading type:			
Loading control:			
Loading ratio:			
Specimen:			
Aditional remarks:			
Cyclic shear yield strength, (Nmm^{-2})			
Shear transition life (cycles)			
Calculated shear transition life (cycles)			
Cyclic shear strength coefficient, K'_o (Nmm^{-2})			
Cyclic shear strain hardening exponent, n'_o			
Shear fatigue strength coefficient, τ'_f (Nmm^{-2})			
Shear fatigue ductility coefficient, γ'_f			
Shear fatigue strength exponent, b_o			
Shear fatigue ductility exponent, c_o			
Shear stress amplitude at number of cycles $N_{E,t}$ (endurance/fatigue limit), (Nmm^{-2})	**10%**	**50%**	**90%**
Shear strain amplitude at number of cycles $N_{E,t}$ (endurance/fatigue limit)	**10%**	**50%**	**90%**
Exponent of *S-N* curve			
Number of cycles corresponding to the endurance/fatigue limit, $N_{E,t}$			

CYCLIC / FATIGUE PROPERTIES - BENDING LOADING, FULLY REVERSED, R=-1

Testing conditions			
Loading type:			
Loading control:			
Loading ratio:			
Specimen:			
Aditional remarks:			
Stress amplitude at number of cycles $N_{E,b}$ (endurance/fatigue limit), (Nmm^{-2})	**10%**	**50%**	**90%**

Strain amplitude at number of cycles $N_{E,b}$ (endurance/fatigue limit)	**10%**	**50%**	**90%**
Exponent of *S-N* curve			
Number of cycles corresponding to the endurance/fatigue limit, $N_{E,b}$			

CYCLIC / FATIGUE PROPERTIES - BENDING LOADING, ROTATING BENDING			
Testing conditions			
Loading type:			
Loading control:			
Loading ratio:			
Specimen:			
Aditional remarks:			
Stress amplitude at number of cycles $N_{E,rb}$ (endurance/fatigue limit), (Nmm^{-2})	**10%**	**50%**	**90%**
Strain amplitude at number of cycles $N_{E,rb}$ (endurance/fatigue limit)	**10%**	**50%**	**90%**
Exponent of *S-N* curve			
Number of cycles corresponding to the endurance/fatigue limit, $N_{E,rb}$			