

Magnetic Susceptibility of Medical Metals

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A new study coauthored by employees of Fort Wayne Metals and MED Institute has recently published in the Journal of Testing and Evaluation. Titled “Magnetic Susceptibility of Common Metals and Alloys Used in Medical Devices”, this study reports the magnetic susceptibility values of 45 metallic materials often used in medical devices. These values can help guide material selection for medical devices seeking an MR Conditional label.

The full text of the article can be found here: [Magnetic Susceptibility of Common Metals and Alloys Used in Medical Devices \(astm.org\)](#)

A list of materials used in the study and their results can be found in Tables 1 and 2 below.

Table 1. Samples used in the study. CW = cold worked. PH = precipitation-hardened.

	Metal/Alloy	Condition	UNS	ASTM	Nominal Composition
Stainless Steels	304V	CW	S30400	A313	Fe-18Cr-8Ni
	304V	Annealed	S30400	A313	Fe-18Cr-8Ni
	316LVM	CW	S31603	F138	Fe-18Cr-14Ni-3Mo
	316LVM	Annealed	S31603	F138	Fe-18Cr-14Ni-3Mo
	455	CW	S45500	A564	Fe-12Cr-9Ni-2Cu
	455	PH	S45500	A564	Fe-12Cr-9Ni-2Cu
	455	Annealed	S45500	A564	Fe-12Cr-9Ni-2Cu
	17-7 PH	CW	S17700	A313	Fe-17Cr-7Ni-1Al
	17-7 PH	PH	S17700	A313	Fe-17Cr-7Ni-1Al
	17-7 PH	Annealed	S17700	A313	Fe-17Cr-7Ni-1Al
Cobalt-Chromium Alloys	FWM 1058	CW	R30003	F1058	Co-20Cr-17Ni-13Fe-7Mo-2Mn
	FWM 1058	Annealed	R30003	F1058	Co-20Cr-17Ni-13Fe-7Mo-2Mn
	FWM 1537	CW	R31537	F1537	Co-28Cr-6Mo
	FWM 1537	Annealed	R31537	F1537	Co-28Cr-6Mo
	35N LT	CW	R30035	F562	Co-35Ni-20Cr-10Mo
	35N LT	Annealed	R30035	F562	Co-35Ni-20Cr-10Mo
	35NLT-DFT-41%Ag	CW	--	--	--
	L605	Annealed	R30605	F90	Co-20Cr-15W-10Ni-3Fe
L605	CW	R30605	F90	Co-20Cr-15W-10Ni-3Fe	
NiTi	NiTi #1	Superelastic Annealed	N01555	F2063	Ni-45Ti
Titanium Alloys	CP Ti Gr 4	CW	R50700	F67	Ti
	CP Ti Gr 4	Annealed	R50700	F67	Ti
	Ti-6Al-4V ELI	CW	R56401	F136	Ti-6Al-4V
	Ti-6Al-4V ELI	Annealed	R56401	F136	Ti-6Al-4V
	Ti6Al7Nb	CW	R56700	F1295	Ti-6Al-7Nb
	Ti6Al7Nb	Annealed	R56700	F1295	Ti-6Al-7Nb
	Ti-β C	CW	R58640	B348	Ti-3Al-8V-6Cr-4Mo-4Zr
	Ti-β C	Aged	R58640	B348	Ti-3Al-8V-6Cr-4Mo-4Zr
RD149-21 (Ti-Nb-Zr-Hf-Sn)	Annealed	--	--	--	
Pure Metals, Precious Metals, Others	99.99 Pt	CW	P04999	B561	Pt
	99.95 Ta	CW	R05200	B365	Ta
	99.95 Au	As Drawn	P00015	--	Au
	99.99 W	As Received	R07004	B760	W
	99.99 Ag	CW	P07010	B413	Ag
	99.99 Cu	CW	C10100	B187	Cu
	99.8 Fe	CW	K00095	A848	Fe
	99.8 Mg	As Received	M19980	B92	Mg
	99.99 Zn	CW	Z13002	B6	Zn
	Fe35Mn	CW	--	--	Fe-35Mn
	WE43	As Extruded	M18432	B107	Mg-4Y-3RE-0.5Zr
	Resoloy®	CW	--	--	Mg-10Dy-1Nd-1Zn-0.2Zr
	ZX10	CW	--	--	Mg-1Zn-0.3Ca-0.1Mn
	Alloy 625	CW	N06625	B446	Ni-22Cr-9Mo-4Fe-4Nb
	Alloy 625	Annealed	N06625	B446	Ni-22Cr-9Mo-4Fe-4Nb
Mo41Re	As Received	--	--	Mo-41Re	

Table 2. Magnetic susceptibility results for each material are presented in ascending order.

Metal/Alloy	Condition	Volumetric Magnetic Susceptibility (PPM)	Saturation Magnetization (T)	Force Ratio	Torque Ratio
99.95 Au	As Drawn	-14	N/A	-0.003	1.85E-08
99.99 Cu	Cold Worked	-7	N/A	-0.003	9.84E-09
99.99 Zn	As Swaged	3	N/A	0.002	2.29E-09
ZX10	Cold Worked	23	N/A	0.050	5.39E-07
99.99 Ag	Cold Worked	26	N/A	0.010	1.18E-07
99.8 Mg	Annealed	63	N/A	0.142	4.20E-06
99.99 W	As Received	69	N/A	0.014	4.48E-07
WE43B	Annealed	80	N/A	0.172	6.43E-06
Mo41Re	As Received	130	N/A	0.039	2.36E-06
Ti-6Al-4V ELI	Annealed	157	N/A	0.154	1.14E-05
CP Ti Gr 4	Cold Worked	169	N/A	0.149	1.18E-05
Ti6Al7Nb	Annealed	173	N/A	0.148	1.20E-05
Ti6Al7Nb	Cold Worked	176	N/A	0.150	1.24E-05
99.95 Ta	Cold Worked	179	N/A	0.042	3.53E-06
Ti-6Al-4V ELI	Cold Worked	190	N/A	0.164	1.46E-05
CP Ti Gr 4	Annealed	193	N/A	0.165	1.49E-05
RD149-21	Annealed	213	N/A	0.148	1.47E-05
Ti-β C	Aged	219	N/A	0.186	1.91E-05
NiTi #1	Superelastic Annealed	237	N/A	0.140	1.55E-05
Ti-β C	Cold Worked	255	N/A	0.205	2.46E-05
99.99 Pt	Cold Worked	263	N/A	0.048	5.88E-06
35NLT-DFT-41%Ag	Cold Worked	514	N/A	0.213	5.13E-05
Inconel 625	Annealed	568	N/A	0.262	6.97E-05
Resoloy	Cold Worked	733	N/A	1.452	4.99E-04
35N LT	Annealed	820	N/A	0.368	1.42E-04
FWM 1537	Annealed	859	N/A	0.391	1.58E-04
35N LT	Cold Worked	898	N/A	0.409	1.72E-04
Fe35Mn	Cold Worked	1089	N/A	0.558	2.85E-04
L605	Annealed	1279	N/A	0.543	3.25E-04
L605	Cold Worked	1298	N/A	0.555	3.38E-04
Inconel 625	Cold Worked	2268	N/A	1.050	1.12E-03
FWM 1058	Annealed	2371	N/A	1.115	1.24E-03
316LVM	Cold Worked	2426	N/A	1.175	1.34E-03
316LVM	Annealed	2759	N/A	1.319	1.71E-03
FWM 1058	Cold Worked	2876	N/A	1.385	1.87E-03
FWM 1537	Cold Worked	2885	N/A	1.353	1.83E-03
17-7 PH	Annealed	2989	N/A	1.470	2.06E-03
304V	Annealed	7525	N/A	3.878	1.37E-02
304V	Cold Worked	50792	N/A	24.91	0.59
17-7 PH	Precipitation Hardened	N/A	1.14	237.46	33.84
17-7 PH	Cold Worked	N/A	1.19	248.00	36.89
455	Precipitation Hardened	N/A	1.43	315.79	56.45
455	Cold Worked	N/A	1.44	303.19	54.57
455	Annealed	N/A	1.54	322.09	62.00
99.8 Fe	Cold Worked	N/A	2.07	428.61	110.90