500X

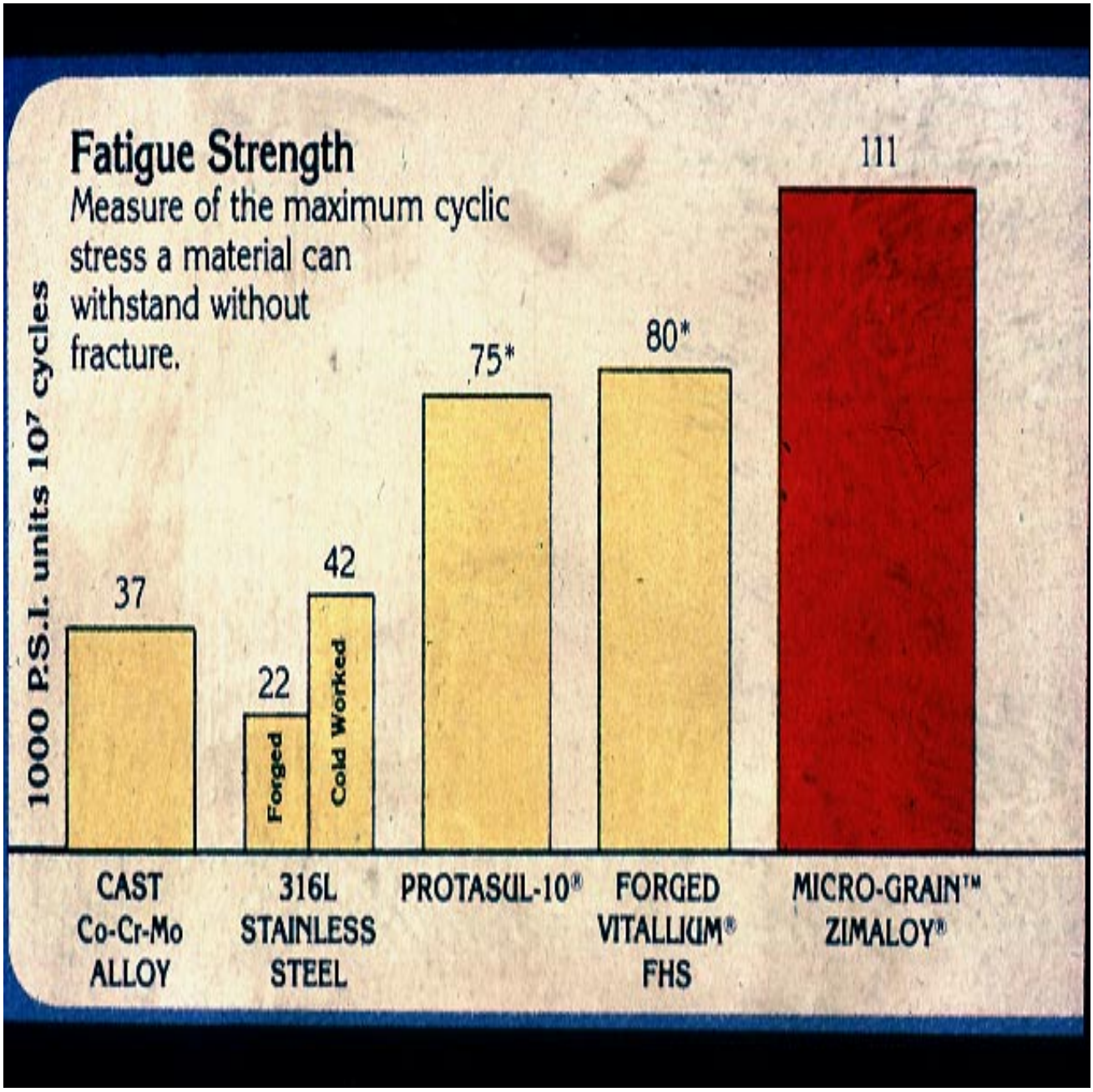
Figure 6. Microstructure of investment cast Co-Cr-Mo alloy. Note: Portions of three grains are observed.

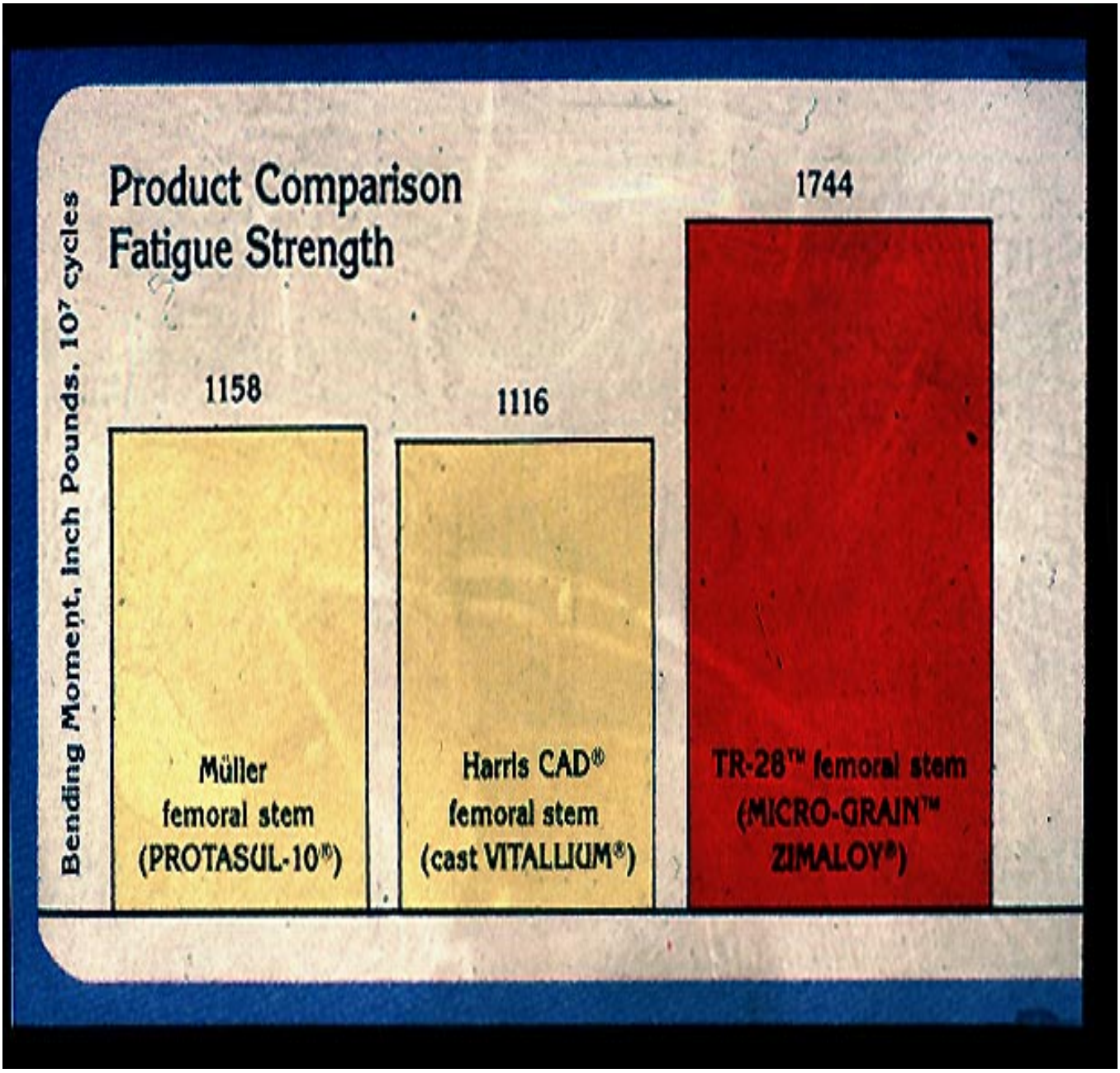
500X

Figure 7. Microstructure of MICRO-GRAIN™ ZIMALOY®. Note: Grain size is ASTM 12

FATIGUE STRENGTHS OF MICRO-GRAIN™ ZIMALOY®
AND
OTHER ORTHOPAEDIC ALLOYS

Alloy	Fatigue Strength (psi)	Source
MICRO-GRAIN ZIMALOY	111,000 130,000	ZIMMER Data* ZIMMER+ Data
Forged VITALLIUM–FHS (Co-Cr-Mo-alloy)	80,000	HOWMEDICA+ Data
MP35N (PROTASUL-10)	70,000–80,000	SULZER+ Data
316L (Cold Worked)	45,000	ZIMMER Data*
Cast Co-Cr-Mo (ZIMALOY)	42,000	ZIMMER Data*
Ti-6Al-4V (TIVANIUM)	75,000	ZIMMER Data*


Fatigue Strength
Measure of the maximum cyclic stress a material can withstand without fracture.
1000 P.S.I. units 10^7 cycles
37
22
Forged
42
Cold Worked
75*
80*
111
CAST Co-Cr-Mo ALLOY
316L STAINLESS STEEL
PROTASUL-10®
FORGED VITALLIUM® FHS
MICRO-GRAIN™ ZIMALOY®


Product Comparison
Fatigue Strength
Bending Moment, Inch Pounds, 10^7 cycles
1158
1116
1744
Müller
femoral stem
(PROTASUL-10®)
Harris CAD®
femoral stem
(cast VITALLIUM®)
TR-28™ femoral stem
(MICRO-GRAIN™
ZIMALOY®)

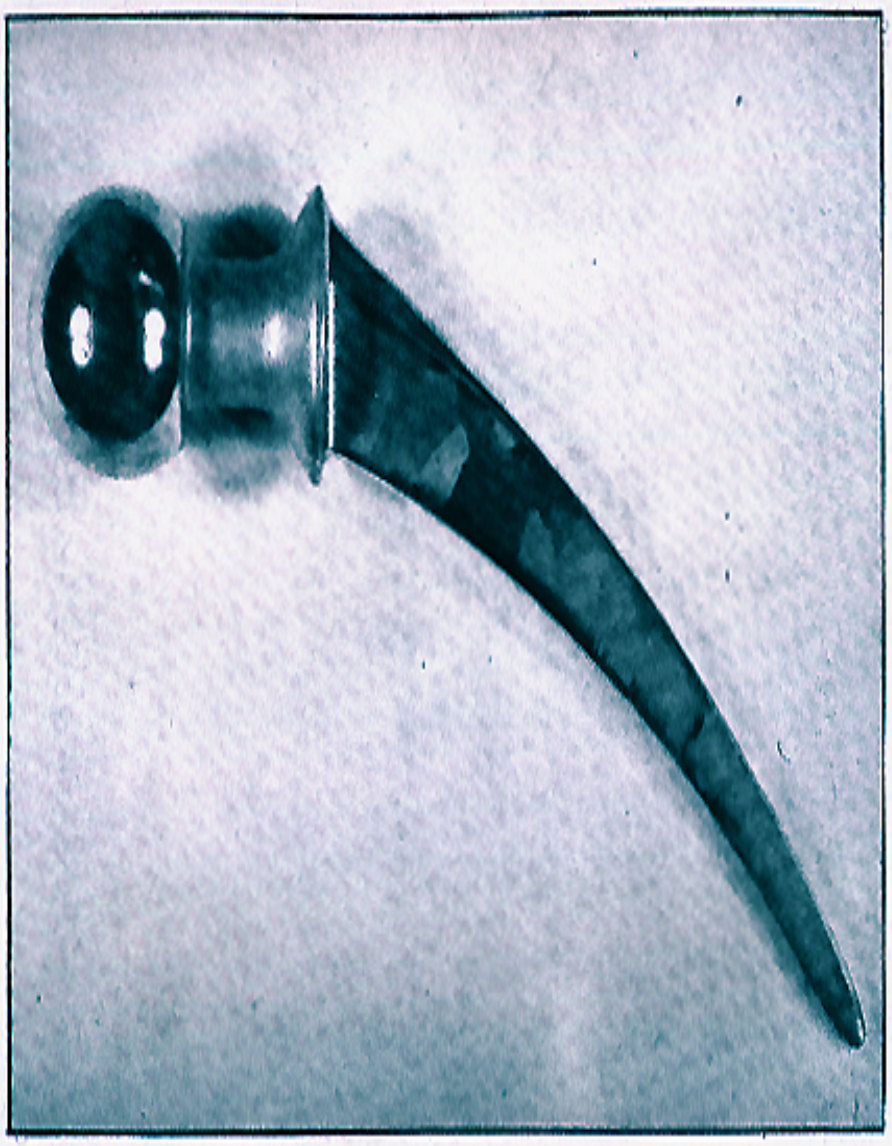
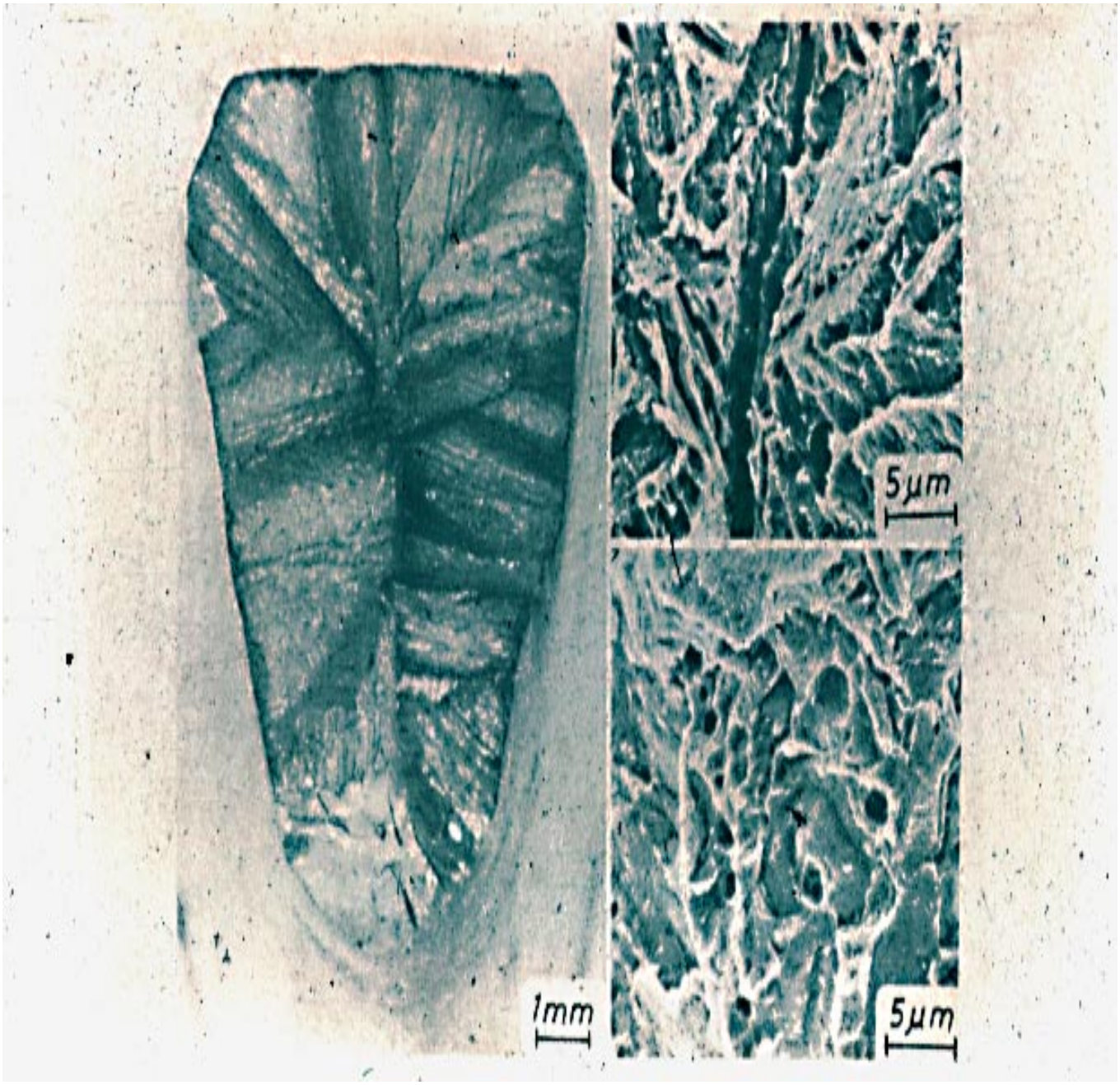
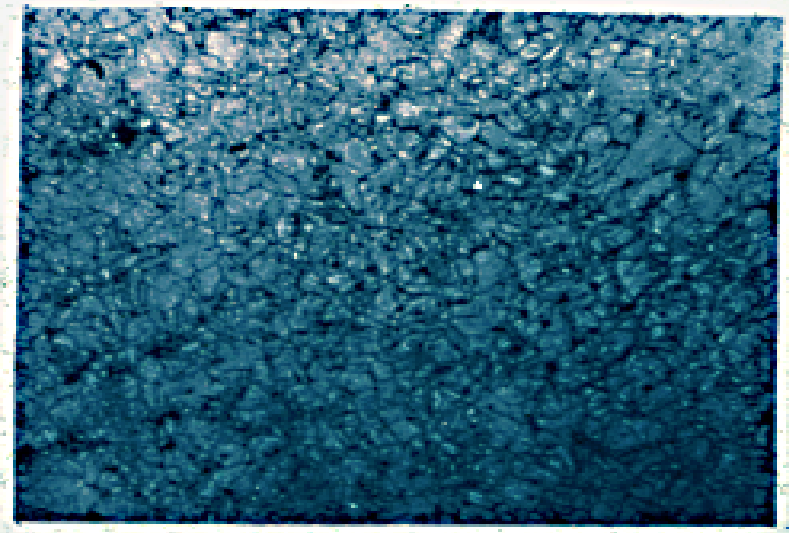


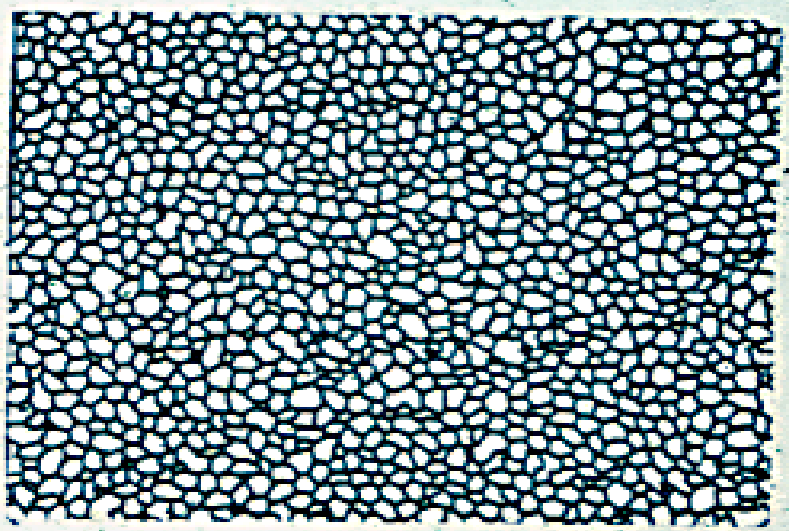
Figure 3. Investment cast Müller prosthesis, macroetched.


1mm
5μm
5μm


1mm
5μm
5μm



PHOTOMICROGRAPH OF VITALLIUM® FHS™ ALLOY MAGNIFICATION - 100X



ASTM GRAIN SIZE NO. 8
MAGNIFICATION - 100X

TYPICAL MECHANICAL PROPERTIES

VITALLIUM® FHS™ ALLOY VS. VITALLIUM® CAST SURGICAL ALLOY

PROPERTY	VITALLIUM® FHS™ ALLOY	VITALLIUM® CAST SURGICAL ALLOY
TENSILE STRENGTH, N/MM^2 (PSI)	1276 (185,000)	793 (115,000)
0.2% OFFSET YIELD STRENGTH, N/MM^2 (PSI)	897 (130,000)	517 (75,000)
PERCENT ELONGATION	15	15
PERCENT REDUCTION OF AREA	15	15
HARDNESS Rc	36	25
FATIGUE STRENGTH, N/MM^2 (PSI) FULL STRESS REVERSAL	793 (115,000)	310 (45,000)