VOLUME, NUMBER AND SURFACE AREA vs. DIAMETER OF PARTICLES

Volume of particles: $V = (\pi/6) \times D^3 \times 10^{-12}$ cm^3/particle

Number of particles: $N = (6W/\pi PD^3) \times 10^{12}$ particles or $1818.9/D^3 \times 10^6$ particles/mg

Surface area of particles: $A = (6W/PD) \times 10^4$ cm^2 or $5.71/D \times 10^2$ cm^2

Where

W = Weight of polymer in gram

P = Density of polymer (polystyrene = 1.05)

D = Diameter of particles in micrometer

Total surface area of 1 mL of 5% w/v (50 mg) particles: A = 2857/D cm^2

Total surface area of 20 μL of 0.25% w/v (50 μg) particles: A = 2.857/D cm^2

1μm = 10^4Å^2 : 1cm = 10^8Å^2 : 1cm^2 = 10^{16}Å^2 : 1cm = 10^4μm

For 1 mL of 1% w/v (10 mg) particles

DIAMETER(μ)	SURFACE AREA(cm^2)	NUMBER(X10^9)	A/Particle (Å^{2}x10^8)	COOH (μeq/g)	NH^2 (μeq/g)
0.05	11428	145513	0.00785	800	320
0.10	5714	18,189	0.0314	400	160
0.20	2857	2,273.6	0.1256	200	80
0.30	1905	673.6	0.283	133.33	53.33
0.40	1429	284.2	0.5024	100	40
0.50	1143	145.51	0.785	80	32
0.80	714	35.53	2.01	50	20
1.0	571	18.19	3.14	40	16
1.5	381	5.389	7.065	26.67	10.67
2.0	286	2.274	12.56	20	8
2.5	229	1.164	19.625	16	6.4
3.0	190	0.6737	28.26	13.33	5.33
3.5	163	0.4242	38.465	11.43	4.57
4.0	143	0.2842	50.24	10	4
4.5	127	0.1996	63.585	8.89	3.56
5.0	114	0.1455	78.5	8	3.2
5.5	104	0.1093	94.99	7.27	2.91
6.0	95.0	0.0842	113.04	6.67	2.67
6.2	92.1	0.0763	120.7	6.45	2.58
6.7	85.2	0.0605	140.95	5.97	2.39
7.0	81.5	0.053	153.86	5.71	2.29
7.7	74.2	0.0398	186.17	5.19	2.08
8.0	71.4	0.035	200.96	5	2
10.0	57.1	0.018	314	4	1.6
15.0	38.1	0.0054	706.5	2.67	1.07
20.0	28.55	0.00227	1256	2	0.8
30.0	19.03	0.00067	2826	1.33	0.53
40.0	14.28	0.000284	5024	1	0.4
50.0	11.42	0.000145	7850	0.8	0.32
75.0	7.61	0.0000431	17662.5	0.53	0.21
100.0	5.71	0.0000182	3140	0.4	0.16
125.0	4.57	0.0000093	49062.5	0.32	0.128
150.0	3.80	0.0000054	70650	0.27	0.11
200.0	2.86	0.0000023	125600	0.2	0.08
300.0	1.90	0.00000067	282600	0.13	0.053

Functional Groups per Particle (Polystyrene)

DIAMETER(μ)	COOH/particle	NH^2/particle
0.05	3.31E+06	1.32E+06
0.1	1.32E+07	5.30E+06
0.2	5.30E+07	2.12E+07
0.3	1.19E+08	4.77E+07
0.4	2.12E+08	8.48E+07
0.5	3.31E+08	1.32E+08
0.8	8.48E+08	3.39E+08
1	1.32E+09	5.30E+08
1.5	2.98E+09	1.19E+09
2	5.30E+09	2.12E+09
2.5	8.28E+09	3.31E+09
3	1.19E+10	4.77E+09
3.5	1.62E+10	6.49E+09
4	2.12E+10	8.48E+09
4.5	2.68E+10	1.07E+10
5	3.31E+10	1.32E+10
5.5	4.01E+10	1.60E+10
6	4.77E+10	1.91E+10
6.2	5.09E+10	2.04E+10
6.7	5.94E+10	2.38E+10
7	6.49E+10	2.60E+10
7.7	7.86E+10	3.14E+10
8	8.60E+10	3.44E+10
10	1.34E+11	5.35E+10
15	2.97E+11	1.19E+11
20	5.31E+11	2.12E+11
30	1.20E+12	4.79E+11
40	2.12E+12	8.48E+11
50	3.32E+12	1.33E+12
75	7.45E+12	2.98E+12
100	1.32E+13	5.29E+12
125	2.07E+13	8.29E+12
150	2.97E+13	1.19E+13
200	5.24E+13	2.09E+13
300	1.20E+14	4.79E+13

Functional Groups per Particle (Magnetic)

DIAMETER(μ)	Particles/mg	COOH/particle	NH^2/particle
0.1	1.2094E+12	1.99E+05	7.97E+04
0.2	1.51175E+11	7.97E+05	3.19E+05
0.3	44792592593	1.79E+06	7.17E+05
0.4	18896875000	3.19E+06	1.27E+06
0.5	9675200000	4.98E+06	1.99E+06
0.8	2362109375	1.27E+07	5.10E+06
1	1209400000	1.99E+07	7.97E+06
1.5	358340740.7	4.48E+07	1.79E+07
2	151175000	7.97E+07	3.19E+07
2.5	77401600	1.25E+08	4.98E+07
3	44792592.59	1.79E+08	7.17E+07
3.5	28207580.17	2.44E+08	9.76E+07
4	18896875	3.19E+08	1.27E+08
4.5	13271879.29	4.03E+08	1.61E+08
5	9675200	4.98E+08	1.99E+08
5.5	7269120.962	6.03E+08	2.41E+08
6	5599074.074	7.17E+08	2.87E+08
6.2	5074519.15	7.66E+08	3.06E+08
6.7	4021106.32	8.94E+08	3.58E+08
7	3525947.522	9.76E+08	3.90E+08
7.7	2649096.56	1.18E+09	4.72E+08
8	2362109.375	1.27E+09	5.10E+08
10	1209400	1.99E+09	7.97E+08
15	358340.7407	4.48E+09	1.79E+09
20	151175	7.97E+09	3.19E+09
30	44792.59259	1.79E+10	7.17E+09
40	18896.875	3.19E+10	1.27E+10
50	9675.2	4.98E+10	1.99E+10
75	2866.725926	1.12E+11	4.48E+10
100	1209.4	1.99E+11	7.97E+10
125	619.2128	3.11E+11	1.25E+11
150	358.3407407	4.48E+11	1.79E+11
200	151.175	7.97E+11	3.19E+11
300	44.79259259	1.79E+12	7.17E+11

CHARACTERISTICS OF SPHERO™ POLYSTYRENE PARTICLES

Density: 1.05 **Refractive Index:** 1.59
Composition: Linear polystyrene
Shape: Uniform microspheres
Porosity: Nonporous
Compatibility with organic solvent: Inert to alcohol and DMSO but soluble in DMF, acetone, acetonitrile, xylene, chloroform and methylene chloride, etc.
Functional groups: Located on the surface with alkyl linker arms. (Amino - C7 linker) (Carboxyl - C9 linker)
Functional group contents:
0.8 μm Carboxyl particles: ~ 50 μeq/g solid (~25Å²/COOH)
0.8 μm Amino particles: ~ 15-20 μeq/g solid (~59Å²/COOH)

Calculation of area / functional group: 1μm = 10^4Å, 1nm = 10Å
Number of 0.8μm particles per g = 3.5x10^12 particles/g
Surface Area / Particle = $4\pi r^2$ or πd^2
= $(0.8\ \mu m)^2$ x 3.14
= $(0.8 \times 10^4 Å)^2$ x 3.14
= $(0.64 \times 10^4 Å)^2$ x 3.14
= $2 \times 10^8 Å^2$
# of carboxyl groups at 50 μeq = $50 \times 10^{-6} \times 6.023 \times 10^{23} = 3 \times 10^{19}$ carboxyl groups/g
# of carboxyl groups / particle = $3x10^{19}$ carboxyl groups/g / $3.5x10^{12}$ particles/g = $8x10^6$ carboxyl groups/particle
Surface Area / group = $2 \times 10^8 Å^2$ / $8x10^6$ carboxyl groups/particle = ~25Å²

AVIDIN POLYSTYRENE PARTICLES (VP-08-10, 0.8 μm, Lot W01):
Covalently coated with egg white avidin
Avidin Contents : ~ 14 μg/mg solid
Binding capacity to Biotin-Fluorescein: ~ 0.37 nmole Biotin-FITC/mg particles or ~ 0.212μg Biotin-FITC/mg particles
Biotin-FITC / particle = 0.212μg Biotin-FITC/mg particles / $2.67x10^9$ particles = $8.4x10^4$
Biotin-FITC / AV = $8.4x10^4$ Biotin-FITC / particle / $4.78x10^4$ AV / particle = ~1.75
(theoretical: ~2 Biotin-FITC / AV)
NOTE: (MW of AV = ~66000), (MW of Biotin-FITC = ~573.64)

AVIDIN MAGNETIC PARTICLES SMOOTH SURFACE PARTICLES (VMS-40-10, 4.1 μm, Lot T01):
Covalently coated with egg white avidin
Avidin Contents : ~ 14 μg/mg solid
Binding capacity to Biotin-Fluorescein: ~ 0.09 nmole Biotin-FITC/mg particles or ~ 0.052μg Biotin-FITC/mg
Biotin-FITC / particle = 0.052μg Biotin-FITC/mg particles / $17.5x10^6$ particles = $3.06x10^6$
Biotin-FITC / AV = $3.06x10^6$ Biotin-FITC / particle / $3.64x10^6$AV / particle = ~0.84
(theoretical: ~2 Biotin-FITC / AV)

ANTIBODY COATED POLYSTYRENE PARTICLES (0.8 μm):
Antibody contents: ~ 14 μg/mg solid; ~ 0.2 μg/cm², ~$1.5x10^4$ IgG/particle
Binding capacity to IgG-FITC: ~ 4 μg/mg
eq: The number of binding sites can be calculated by the binding capacity listed on the Technical Data Sheet. for example: MPFc-30-5, Lot R01 has a binding capacity of 1.7μg/mg of particles. The number of binding sites can be calculated as follows.
(1.7x10^-6/160500) x 6.023x10^23 = 6.38x10^12 IgG-FITC per mg of particles.
Number of 3.2μm particles per mg = 55.5x10^6 particles/mg
# of IgG-FITC/particle = 6.38x10^12 / 55.5x10^6 particles/mg = 1.15x10^5 IgG-FITC per particle.

NOTE: (MW of IgG = ~160500) The binding capacity is determined by binding a known concentration of IgG-FITC to a known amount of particles.

Determination of the Number of SAV / Particle

Number Biotin-FITC binding sites: binding capacity in moles/mg x 6.023×10^{23} / number of beads / mg
Since there are two binding sites available per SAV when coated on the particles multiple the number of Biotin-FITC binding sites x 2 to obtain the number of SAV / particle

STREPTAVIDIN POLYSTYRENE PARTICLES (SVP-08-10, 0.8 μm, Lot V01:

Covalently coated with lyophilized Streptavidin from Streptomyces avidinii
SAV Contents : ~ 21 μg/mg solid
Binding capacity to Biotin-Fluorescein: ~ 0.806 nmole Biotin-FITC/mg particles or
~ 0.462μg Biotin-FITC/mg particles
# Biotin-FITC / particle = 0.462μg Biotin-FITC/mg particles / 3.5×10^9 particles = 1.39×10^5
# Biotin-FITC / SAV = 1.39×10^5 Biotin-FITC / particle / 6.85×10^4 SAV / particle = ~2.03
(theoretical: ~2 Biotin-FITC / SAV)
NOTE: (MW of SAV = ~55000)

STREPTAVIDIN POLYSTYRENE PARTICLES (SVP-60-5, 6.7 μm, Lot W02):

Covalently coated with lyophilized Streptavidin from Streptomyces avidinii
SAV Contents : ~ 21 μg/mg solid
Binding capacity to Biotin-Fluorescein: ~ 0.806 nmole Biotin-FITC/mg particles or
~ 0.462μg Biotin-FITC/mg particles
# Biotin-FITC / particle = 0462μg Biotin-FITC/mg particles / 3.5×10^9 particles = 1.39×10^5
# Biotin-FITC / SAV = 1.39×10^5 Biotin-FITC / particle / 6.85×10^4 SAV / particle = ~2.03
(theoretical: ~2 Biotin-FITC / SAV)
NOTE: (MW of SAV = ~55000)

Determination of the Number of SAV-FITC / Particle for Biotin Coated Polystyrene Particles

MW of SAV-FITC = 60,000

BIOTIN POLYSTYRENE PARTICLES (TP-08-10, 0.81 μm, Lot V01:

Binding capacity to SAV-Fluorescein: ~ 11μg SAV-FITC/mg particles
moles of SAV-FITC = 11×10^{-6} / 60,000 = 1.83×10^{-10} moles
1mg of 0.81μg = 3.4×10^9 particles
SAV-FITC / particle = 1.83×10^{-10} moles x 6.023×10^{23} / 3.4×10^9 particles = 3.2×10^4
= 3.2×10^4 SAV-FITC / particle

Determination of the Number of IgG-FITC / Particle for Protein A Coated Polystyrene Particles

MW of IgG-FITC = 160,500

PROTEIN A POLYSTYRENE PARTICLES (PAP-08-10, 0.86 μm, Lot S01:

Binding capacity to Hu IgG-Fluorescein: ~ 3.9 μg IgG-FITC/mg particles
moles of IgG-FITC = 3.9×10^{-6} / 160,500 = 2.43×10^{-11} moles
1mg of 0.86μg = 2.86×10^9 particles
IgG-FITC / particle = 2.43×10^{-11} moles x 6.023×10^{23} / 2.86×10^9 particles = 5.1×10^4
= 5.1×10^4 Hu IgG-FITC / particle
# of Protein A per particle = 7.04×10^5 Protein G/particle or 0.072 IgG-FITC / Protein A

Determination of the Number of IgG-FITC / Particle for Protein G Coated Polystyrene Particles

MW of IgG-FITC = 160,500

PROTEIN G POLYSTYRENE PARTICLES (PGP-08-10, 0.86 μm, Lot V01:

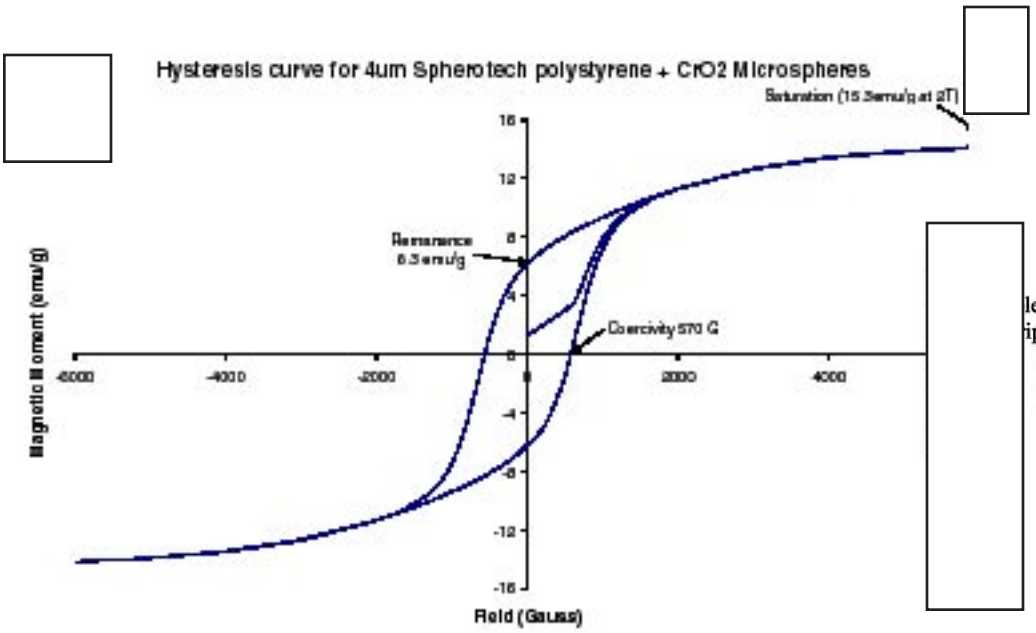
Binding capacity to Hu IgG-Fluorescein: ~ 8.5 μg IgG-FITC/mg particles
moles of IgG-FITC = 8.5×10^{-6} / 160,500 = 5.3×10^{-11} moles
1mg of 0.86μg = 2.86×10^9 particles
IgG-FITC / particle = 5.3×10^{-11} moles x 6.023×10^{23} / 2.86×10^9 particles = 1.2×10^4
= 1.2×10^4 Hu IgG-FITC / particle
# of Protein G per particle = 2.62×10^5 Protein G/particle or 0.043 IgG-FITC / Protein G

CAT. NO.	LOT NO.	amount of analyte bound to 1 mg particle			nmole Bio-F
BMX-10-10	Q01	>20.0 ug			
FMFc-25-5	P01	1.10 ug			
FMFc-40-5	P01	600 ng			
FMMFc-2058-5	P01	0.90 ug			
FMXA-25-5	P01	1.85 ug			
FMXA-40-5	Q01	3.17 ug			
GMX-10-10	Q01	>20.0 ug			
GMXA-40-10	W01	1667 ng			
GPMX-10-10	Q01	>20.0 ug			
GSHP-60-5	Q01	160 ng			
HFP-0852-5	P01	2.20 ug			
HFP-0856-5	P01	750 ng			
HFP-0862-5	P01	1.20 ug			
HM-40-10	J01	1.30 ug			
HMS-30-10	X01	0.87 ug			
HMS-40-10	T01	0.66 ug			
HMX-10-10	M01	12.0 ug			
HrMX-10-10	Q01	>20.0 ug			
HuMX-10-10	Q01	>20.0 ug			
HUP-08-5	P01	4.25 ug			
HUP-30-5	T01	1.20 ug			
HUP-60-5	W01	392 ng			
ITP-60-5	S01	400 ng			
MFcP-3052-5	S01	1.45 ug			
MFcP-3056-5	T01	1.18 ug			
MFcp-3058-5	U01	0.55 ug			
MFcP-3069-5	Q01	250 ng			
MFP-0552-5	R01	2.04 ug			
MFP-0852-5	L01	readings were off-scale			
MFP-0856-5	K01	readings were off-scale			
MFP-0858-5	Q01	1.28 ug			
MFP-0862-5	L01	readings were off-scale			
MFP-2052-5	Q01	1.08 ug			
MFP-2056-5	Q01	0.78 ug			
MFP-2058-5	Q01	0.73 ug			
MFP-2062-5	Q01	0.65 ug			
MFP-2070-5	Q01	0.85 ug			
MM-40-10	M01	800 ng			
MMFc-40-10	P01	500 ng			
MMSFc-30-10	T01	610 ng			
MMSFc-40-10	W01	1.49 ug			
MMSXA-40-10	V01	1200 ng			
MMX-10-10	Q01	9.13 ug			
MMXA-10-10	Q01	8.13 ug			
MMXA-40-10	W01	1.34 ug			
MP-08-20	U01	5.12 ug			
MP-60-5	W01	1.9 ug			
MPFc-08-20	Q01	4.50 ug			
MPFc-30-5	U01	1.70 ug			
MPFc-60-5	W01	1.35 ug			
MPFc-150-4	W01	0.15 ug			
MPXA-08-20	V01	3.80 ug			
MPXA-60-5	V01	1.75 ug			
MPXA-60-5	U01	1.3 ug			
MSGPX-50-5	V01	5.13 ug			
MsMX-10-10	Q01	>20.0 ug			
NVP-20-5	V01	263 ng			0.46
NVP-60-5	V01	79.6 ng			0.14
PAFP-0552-5	Q01	Hu- 7.68 ug	Rb- 7.45 ug	Ms- 7.4 ug	

PAFP-0556-5	R01	Hu- 5.9 ug	Rb- 3.8 ug	Ms- 5.5 ug	
PAFP-0558-5	Q01	Hu- 6.6 ug	Rb- 4.8 ug	Ms- 2.0 ug	
PAFP-0562-5	Q01	Hu- 6.1 ug	Rb- 4.3 ug	Ms- 1.7 ug	
PAM-40-5	Q01	Hu- 3.6 ug	Rb- 1.8 ug	Ms- 2.2 ug	
PAMS-30-5	W01	Hu- 6.8 ug	Rb- 6.55 ug	Ms- 4.3 ug	
PAMS-40-5	V01	Hu- 2.8 ug	Rb- 3.23 ug	Ms- 1.8 ug	
PAMX-10-5	P01	Hu- 4.6 ug	Rb- 4.8 ug	Ms- 3.7 ug	
PAP-08-5	S01	Hu- 3.9 ug	Rb- 3.8 ug	Ms- 4.1 ug	
PAP-20-5	R01	Hu- 5.1 ug	Rb- 3.6 ug	Ms- 4.6 ug	
PAP-60-5	X01	Hu- 2.5 ug	Rb- 3.0 ug	Ms- 1.75 ug	
PGFP-0552-5	R01	Hu- 6.4 ug	Rb- 5.5 ug	Ms- 5.5 ug	
PGFP-0556-5	X01	Hu- 7.5 ug	Rb- 6.3 ug	Ms- 6.6 ug	
PGFP-0558-5	R01	Hu- 6.1 ug	Rb- 5.7 ug	Ms- 5.6 ug	
PGFP-0562-5	R01	Hu- 5.2 ug	Rb- 5.1 ug	Ms- 4.9 ug	
PGM-40-5	R01	Hu- 3.2 ug	Rb- 3.3 ug	Ms- 5.2 ug	
PGMS-30-5	V01	Hu- 4.3 ug	Rb- 4.7 ug	Ms- 1.75 ug	
PGMS-40-5	U01	Hu- 2.0 ug	Rb- 2.48 ug	Ms- 3.25 ug	
PGP-05-5	T01	Hu- 8.85 ug	Rb- 9.03 ug	Ms- 4.9 ug	
PGP-08-5	V01	Hu- 8.5 ug	Rb-8.9 ug	Ms- 4.2 ug	
PGP-20-5	W01	Hu- 4.18 ug	Rb- 4.05 ug	Ms- 1.65 ug	
PGP-30-5	V01	Hu- 3.6 ug	Rb- 2.8 ug	Ms- 2.37 ug	
PGP-40-5	V01	Hu- 2.2 ug	Rb- 2.4 ug	Ms- 1.07 ug	
PGP-60-5	W01	Hu- 1.68 ug	Rb- 2.1 ug	Ms- 2.83 ug	
PrMX-10-10	Q01	>20.0 ug			
RbMX-10-10	Q01	>20.0 ug			
RM-40-10	J01	1.10 ug			
RMFc-40-10	S01	1.77 ug			
RMS-40-10	T01	1.19 ug			
RMX-10-10	U01	8.13 ug			
RPFc-08-20	R01	14.2 ug			
RPFc-60-5	W01	867 ng			
RtMX-10-10	Q01	>20.0 ug			
RTPFc-60-5	X01	819 ng			
RTPXA-60-5	W01	1.29 ug			
SRM-40-5	Q01	3.87 ug			
SVBP-03-10	Q01	220 ng			0.39
SVFM-40-5	V01	660 ng			1.15
SVFP-0552-5	T01	600 ng			1.05
SVFP-0556-5	W01	900 ng			1.55
SVFP-6056-5	U01	84 ng			0.15
SVM-08-10	W01	700 ng			1.22
SVM-10-10	W01	440 ng			0.77
SVM-15-10	V01	480 ng			0.84
SVM-20-10	X01	420 ng			0.73
SVM-30-10	W01	220 ng			0.39
SVM-40-10	V01	180 ng			0.31
SVM-40-100	W01	184 ng			0.32
SVM-50-5	S01	206 ng			0.36
SVM-60-5	Q01	116 ng			0.20
SVM-80-5	U01	138 ng			0.24
SVMS-30-10	W01	115 ng			0.20
SVMS-30-10	V01	120 ng			0.21
SVMS-40-10	T01	96.0 ng			0.16
SVMX-10-10	P01	510 ng			0.90
SVP-03-10	Q01	200 ng			0.35
SVP-05-10	W01	815 ng			1.42
SVP-08-10	U02	600 ng			1.05
SVP-08-10	V01	465 ng			0.81
SVP-10-10	W01	356 ng			0.62
SVP-15-10	V01	270 ng			0.47

SVP-20-5	W01	204 ng	0.36
SVP-30-5	W02	155 ng	0.27
SVP-40-5	X01	109.0 ng	0.19
SVP-50-5	W01	78.0 ng	0.136
SVP-60-5	W02	103.0 ng	0.18
SVP-100-4	W01	30 ng	0.053
SVP-150-4	U01	27.0 ng	0.047
SVP-200-4	V02	14.0 ng	0.025
SVP-900-4	V01	9.0 ng	0.016
SVPX-08-10	P01	45.4 ng	0.080
TFM-4056-5	U01	0.93 ug	
TFP-0552-5	W01	readings were off-scale	
TFP-0556-5	Q01	readings were off-scale	
TFP-0858-5	R01	2.35 ug	
TFP-2058-5	R01	650 ng	
TFP-3067-5	W01	3.05 ug	
TFP-5058-5	R01	150 ng	
TFP-5067-5	X01	310 ng	
TFP-7052-5	W01	160 ng	
TFP-7056-5	V01	250 ng	
TM-10-10	V01	34.4 ug	
TM-40-10	U01	4.0 ug	
TM-60-10	T01	5.37 ug	
TMX-10-10	U01	8.40 ug	
TP-08-10	X01	11.00 ug	
TP-30-5	V01	3.17 ug	
TP-60-5	W01	670 ng	
TP-60-5	V01	620 ng	
TPX-100-5	V01	490 ng	
VFP-0552-5	V01	233 ng	0.41
VFP-0558-5	W01	200 ng	0.35
VFP-0562-5	T01	TBD	TBD
VFP-0852-5	T01	268 ng	0.468
VFP-0856-5	T01	87 ng	0.152
VFP-0862-5	N01	245 ng	0.43
VFP-0870-5	S01	282 ng	0.49
VFP-2052-5	R01	110 ng	0.19
VFP-2058-5	R01	90.0 ng	0.16
VM-10-10	W01	419 ng	0.73
VM-40-10	J01	70.0 ng	0.12
VM-40-100	R01	110 ng	0.19
VM-60-10	P01	86.0 ng	0.15
VM-80-5	R01	115 ng	0.20
VMS-30-10	V01	59 ng	0.103
VMS-40-10	T01	52 ng	0.09
VMX-10-10	L01	571 ng	1.00
VMX-10-10	L02	571 ng	1.00
VMX-10-100	K01	571 ng	1.00
VP-08-10	W01	212 ng	0.37
VP-10-10	Q01	255 ng	0.45
VP-30-5	U01	35 ng	0.061
VP-30-5	W01	60 ng	0.104
VP-30-5	W03	82 ng	0.143
VP-60-5	P01	TBD	TBD

Magnetic Hysteresis Curve for Feromagnetic Particles



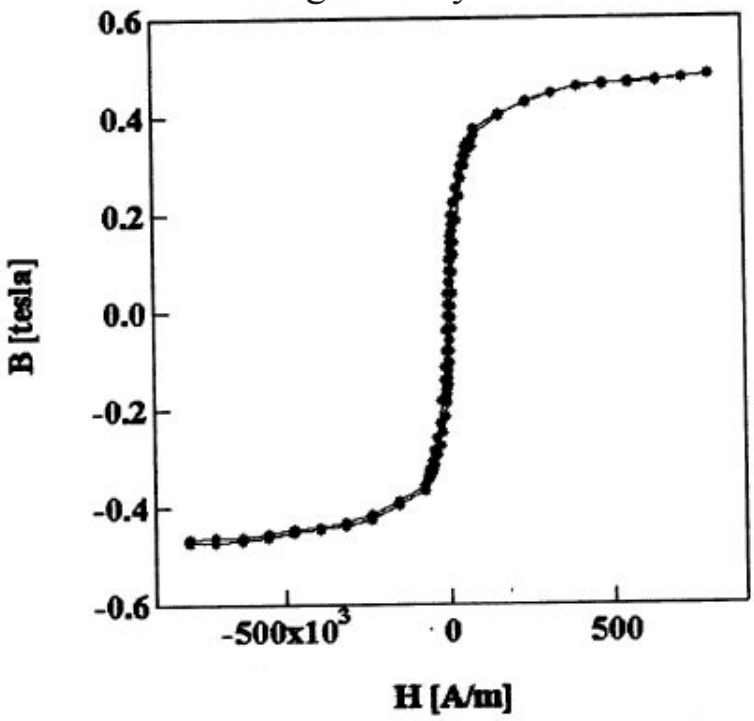
le: Spherotech, Inc. Cat. No. CFM-40
iption: SPHERO™ Ferromagnetic Particle
Diameter *D*: 4.40μm
Average Density = 1.81g/mL
Chromium dioxide ($Cr0_2$) = 20%

The amount of sample used for measurement: 5.0×10^{-3}g
Volume: $V = 2.76 \times 10^{-2}cm^3$
Volume of Chromium dioxide: $V_{chromium} = V \times 20\% = 5.52 \times 10^{-3}cm^3$

Histeresis curve is measured with Oe vs. emu and converted to B vs. H

Conversion factor
$1\ [Oe] = (1000/4\pi)\ [A/m]$
$1\ [emu/\ cm^3] = 4\pi \times 10^{-4}\ [T]$
In this measurement, $1\ [emu] = 4\pi \times 10^{-4} / V_{chromium} = 0.228[T]$

Magnetic Hysteresis Curve for Paramagnetic Particles



Sample: Spherotech, inc. Magnetic beads CM-10-10
Diameter *D* = 1.2 micron (since it is 1.0-1.4um on the catalog,
Average density 1.58
Iron content (gamma-ferric oxide) 12%

The amount of sample used for the measurement: 4.7×10^{-2} [g]
Volume: $V = 2.97 \times 10^{-2}\ [cm^3]$
Volume of iron oxide: $V_{iron} = V \times 12\% = 3.56 \times 10^{-3}\ [cm^3]$

Histeresis curve is measured with Oe vs emu and converted to B vs H

Conversion factor
$1\ [Oe] = (1000/4\pi)\ [A/m]$
$1\ [emu/cm^3] = 4\pi \times 10^{-4}\ [T]$
In this measurement, $1\ [emu] = 4\pi \times 10^{-4} / V_{iron} = 0.353\ [T]$

Saturation Magnetization, Ms: ~0.46 [T]
Susceptibility: $\chi = B/\mu_0 H = 11.3$