

## Spherotech, Inc.

1840 Industrial Dr., Suite 270, Libertyville, IL 60048

### SPHERO™ Magnetic Particles

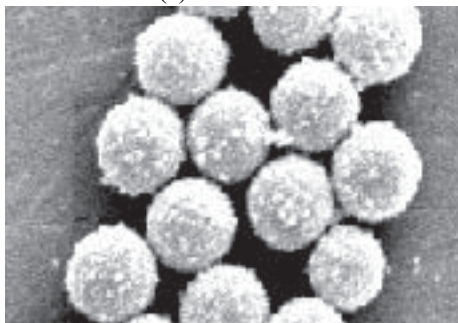
The **SPHERO™ Magnetic Particles (Paramagnetic Particles)** are prepared using a patented procedure (US Patent No. 5,091,206). They are manufactured by coating a layer of iron oxide and polystyrene onto polystyrene core particles. The **SPHERO™** magnetic particles are relatively uniform in size, spherical in shape and paramagnetic in nature. The paramagnetic nature of the particles allows them to be separated using a magnet, but the particles will resuspend easily when removed from the magnet. They do not retain any significant magnetism even after repeat exposure to strong magnetic fields.

The **SPHERO™ Smooth Surface Magnetic Particles** have a thick layer of polymer coating on the surface of the particles to fully encapsulate the iron oxide coating. There is no exposed iron oxide on the surface of the particles. The **SPHERO™ Smooth Surface Magnetic Particles** are particularly useful in applications where exposed iron oxide may interfere with the enzymatic activities or cause other undesirable interferences. The **SPHERO™ Magnetic Particles** are used for cell separation, affinity purification, DNA probe assays, magnetic particle EIA, etc.

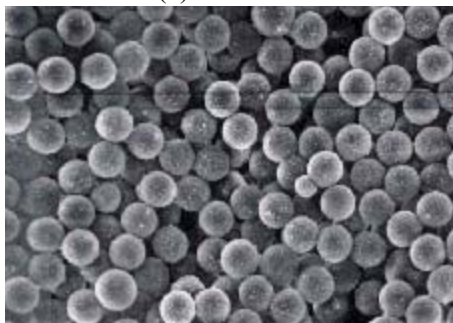
The **SPHERO™ Cross-Linked Magnetic Particles** are prepared to render them resistant to common organic solvents such as acetone, acetonitrile, DMF and chloroform. Since these particles are manufactured by coating a layer of polymer onto the surface of iron oxide crystals, they are not uniform in size and are essentially nonspherical in shape. Their overall size ranges from ~1.0 - 2.0  $\mu\text{m}$ . However, cross-linked magnetic particles have significantly greater surface area and higher magnetite content (70%) compared to the 4.0  $\mu\text{m}$  uniform magnetic particles. Large surface area combined with higher magnetite content make **SPHERO™ Cross-Linked Magnetic Particles** ideal solid phase for use in cell separation, magnetic removal of microorganisms, viruses and cross reactants in serum, as well as, affinity purification applications.

Representative Scanning Electron Microscope photos of **SPHERO™ Magnetic Particles** are shown below: (a) CM-30-10 at 2000X, (b) CM-40-10 at 1000X, (c) Cross section of **SPHERO™ Magnetic Particles**, dark specks in (c) are magnetite on the surface of core particles. The SEM photo of **SPHERO™ Smooth Surface Magnetic Particles**, CMS-40-10, is shown in (d) at 5000x.

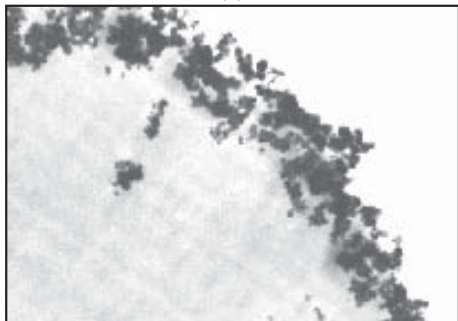
(a) CM-30-10



(b) CM-40-10



(c)



(d) CMS



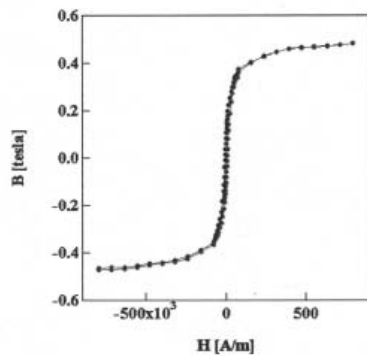
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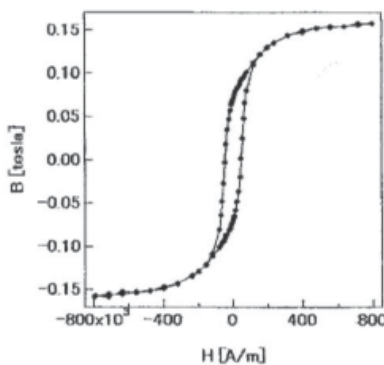
## Magnetic Characteristics of SPHERO™ Magnetic Particles and Ferromagnetic Particles

The magnetic characteristics of magnetic particles are determined by measuring the magnetic Hysteresis Loop of magnetic particles with a magnetometer as shown below. The magnetic particles are subjected to an increasing magnetizing field (H in Oersteds) in one direction, while sensing the magnetic field (B in Gauss) in the sample to reach maximum or saturation magnetization (Bm). The magnetizing field is then returned to zero and the field retained is measured as the remnant magnetization (Br). Finally, the field is reversed until magnetization is at zero again. The corresponding field strength (Hc) is the coercivity of the magnetic particles. If the Br and Hc are near zero, the magnetic particles are characterized as superparamagnetic as shown in Fig. (A). On the other hand, the Ferromagnetic Particles will have Hysteresis Loop similar to Fig. (B).

**Fig. (A) Magnetic Hysteresis Loop of CM-10-10 showing superparamagnetic characteristics**



**Fig. (B) Magnetic Hysteresis Loop of FCM-40-10 showing ferromagnetic characteristics**



## SPHERO™ Magnetic Polystyrene Particles

Product	Size, $\mu\text{m}$	% w/v	Catalog No.	Unit
Magnetic Polystyrene	2.0-2.9	2.5	PM-20-10	10 mL
Magnetic Polystyrene	2.0-2.9	2.5	PM-20-100	100 mL
Magnetic Polystyrene	3.0-3.9	2.5	PM-30-10	10 mL
Magnetic Polystyrene	3.0-3.9	2.5	PM-30-100	100 mL
Magnetic Polystyrene	4.0-4.5	2.5	PM-40-10	10 mL
Magnetic Polystyrene	4.0-4.5	2.5	PM-40-100	100 mL

## SPHERO™ Carboxyl Magnetic Particles

Product	Size, $\mu\text{m}$	% w/v	Catalog No.	Unit
Carboxyl Magnetic	0.1-0.39	2.5	CM-025-10	10 mL
Carboxyl Magnetic	0.4-0.69	2.5	CM-05-10	10 mL
Carboxyl Magnetic	0.7-0.9	2.5	CM-08-10	10 mL
Carboxyl Magnetic	1.0-1.4	2.5	CM-10-10	10 mL
Carboxyl Magnetic	1.0-1.4	2.5	CM-10-100	100 mL
Carboxyl Magnetic	1.5-1.9	2.5	CM-15-10	10 mL
Carboxyl Magnetic	1.5-1.9	2.5	CM-15-100	100 mL
Carboxyl Magnetic	2.0-2.9	2.5	CM-20-10	10 mL
Carboxyl Magnetic	2.0-2.9	2.5	CM-20-100	100 mL
Carboxyl Magnetic	3.0-3.9	2.5	CM-30-10	10 mL
Carboxyl Magnetic	3.0-3.9	2.5	CM-30-100	100 mL
Carboxyl Magnetic	4.0-4.5	2.5	CM-40-10	10 mL
Carboxyl Magnetic	4.0-4.5	2.5	CM-40-100	100 mL
Carboxyl Magnetic	5.0-5.9	2.5	CM-50-10	10 mL
Carboxyl Magnetic	6.0-7.9	2.5	CM-60-10	10 mL
Carboxyl Magnetic	6.0-7.9	2.5	CM-60-100	100 mL
Carboxyl Magnetic	8.0-9.9	2.5	CM-80-10	10 mL
Carboxyl Magnetic	10.0-13.9	1.0	CM-100-10	10 mL
Carboxyl Magnetic	13.0-17.9	1.0	CM-150-10	10 mL
Carboxyl Magnetic	18.0-22.9	1.0	CM-200-10	10 mL

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### SPHERO™ Amino Magnetic Particles

Product	Size, $\mu\text{m}$	% w/v	Catalog No.	Unit
Amino Magnetic	1.0-1.4	2.5	AM-10-10	10 mL
Amino Magnetic	1.0-1.4	2.5	AM-10-100	100 mL
Amino Magnetic	1.5-1.9	2.5	AM-15-10	10 mL
Amino Magnetic	1.5-1.9	2.5	AM-15-100	100 mL
Amino Magnetic	2.0-2.9	2.5	AM-20-10	10 mL
Amino Magnetic	2.0-2.9	2.5	AM-20-100	100 mL
Amino Magnetic	3.0-3.9	2.5	AM-30-10	10 mL
Amino Magnetic	3.0-3.9	2.5	AM-30-100	100 mL
Amino Magnetic	4.0-4.5	2.5	AM-40-10	10 mL
Amino Magnetic	4.0-4.5	2.5	AM-40-100	100 mL
Amino Magnetic	6.0-8.0	1.0	AM-60-10	10 mL
Amino Magnetic	6.0-8.0	1.0	AM-60-100	100 mL
Amino Magnetic	8.0-9.9	1.0	AM-80-10	10 mL

### SPHERO™ Magnetic Polystyrene Particles, Smooth Surface

Product	Size, $\mu\text{m}$	% w/v	Catalog No.	Unit
Magnetic Polystyrene, Smooth Surface	3.0-3.9	2.5	PMS-30-10	10 mL
Magnetic Polystyrene, Smooth Surface	4.0-5.0	2.5	PMS-40-10	10 mL
Magnetic Polystyrene, Smooth Surface	4.0-5.0	2.5	PMS-40-100	100 mL

### SPHERO™ Carboxyl Magnetic Particles, Smooth Surface

Product	Size, $\mu\text{m}$	% w/v	Catalog No.	Unit
Carboxyl Magnetic, Smooth Surface	3.0-3.9	2.5	CMS-30-10	10 mL
Carboxyl Magnetic, Smooth Surface	3.0-3.9	2.5	CMS-30-100	100 mL
Carboxyl Magnetic, Smooth Surface	4.0-5.0	2.5	CMS-40-10	10 mL
Carboxyl Magnetic, Smooth Surface	4.0-5.0	2.5	CMS-40-100	100 mL
Carboxyl Magnetic, Smooth Surface	8.0-9.9	1.0	CMS-80-10	10 mL

### SPHERO™ Amino Magnetic Particles, Smooth Surface

Product	Size, $\mu\text{m}$	% w/v	Catalog No.	Unit
Amino Magnetic, Smooth Surface	4.0-5.0	2.5	AMS-40-10	10 mL
Amino Magnetic, Smooth Surface	4.0-5.0	2.5	AMS-40-100	100 mL

### SPHERO™ Magnetic Cross-linked Particles

Product	Size, $\mu\text{m}$	% w/v	Catalog No.	Unit
Magnetic, Cross-linked, granules, non-uniform	3.0-6.0	2.5	PMX-40-10	10 mL
Amino Magnetic, Cross-linked, granules, non-uniform	~1-2 $\mu\text{m}$	2.5	AMX-10-10	10 mL
Amino Magnetic, Cross-linked, granules, non-uniform	~1-2 $\mu\text{m}$	2.5	AMX-10-100	100 mL
Amino Magnetic, Cross-linked, granules, non-uniform	3.0-6.0	2.5	AMX-40-10	10 mL
Amino Magnetic, 0.5% DVB Cross-linked,, uniform	13.0-17.9	1.0	AMX-150-5	5 mL
Carboxyl Magnetic, Cross-linked, granules, non-uniform	~1-2 $\mu\text{m}$	2.5	CMX-10-10	10 mL
Carboxyl Magnetic, Cross-linked, granules, non-uniform	~1-2 $\mu\text{m}$	2.5	CMX-10-100	100 mL
Carboxyl Magnetic, Cross-linked, granules, non-uniform	3.0-6.0	2.5	CMX-40-10	10 mL

### SPHERO™ Diethylamino Magnetic Particles

Product	Size, $\mu\text{m}$	% w/v	Catalog No.	Unit
Diethylamino Magnetic	3.0-3.9	2.5	DEM-30-10	10 mL

### SPHERO™ Dimethylamino Magnetic Particles

Product	Size, $\mu\text{m}$	% w/v	Catalog No.	Unit
Dimethylamino Magnetic	3.0-3.9	2.5	DM-30-10	10 mL

### SPHERO™ Epoxy Magnetic Particles, Smooth Surface

Product	Size, $\mu\text{m}$	% w/v	Catalog No.	Unit
Epoxy Magnetic, Smooth Surface	3.0-3.9	2.5	EMS-30-10	10 mL

### SPHERO™ Hydroxyethyl Magnetic Particles, Smooth Surface

Product	Size, $\mu\text{m}$	% w/v	Catalog No.	Unit
Hydroxyethyl Magnetic, Smooth Surface	3.0-3.9	2.5	HEMS-30-10	10 mL

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### SPHERO™ Fluorescent Magnetic Particles

The SPHERO™ Fluorescent Magnetic Particles are magnetic particles that are also fluorescent. We can prepare magnetic particles incorporated with a wide variety of fluorophores.

#### SPHERO™ Fluorescent Magnetic Particles

Product	Size, $\mu\text{m}$	% w/v	Catalog No.	Unit
Fluorescent Nile Red Magnetic	4.0-4.9	1.0	FPM-4056-2	2 mL
Fluorescent UV Magnetic Particles	5.0-5.9	0.1	FPM-5041-2	2 mL

#### SPHERO™ Amino Fluorescent Magnetic Particles

Product	Size, $\mu\text{m}$	% w/v	Catalog No.	Unit
Fluorescent Yellow Amino Magnetic	2.0-2.9	1.0	FAM-2052-2	2 mL
Fluorescent Pink Amino Magnetic	2.0-2.9	1.0	FAM-2058-2	2 mL
Fluorescent Nile Red Amino Magnetic	4.0-4.9	1.0	FAM-4056-2	2 mL

#### SPHERO™ Carboxyl Fluorescent Magnetic Cross-linked Particles

Product	Size, $\mu\text{m}$	% w/v	Catalog No.	Unit
Fluorescent Blue Carboxyl Magnetic, Cross-linked, granules, non-uniform	~1-2 $\mu\text{m}$	1.0	FCMX-1068-2	2 mL

#### SPHERO™ Ferromagnetic Particles

Unlike paramagnetic particles that are made using iron oxide, SPHERO™ Ferromagnetic Particles are prepared using chromium dioxide coated onto uniform polystyrene particles. These particles retain magnetism once exposed to a magnetic field. The particles can be demagnetized and re-magnetized repeatedly and reproducibly. Ferromagnetic particles have been used for studying mechanotransduction across the cell surface and through the cytoskeleton by binding ferromagnetic particles to cell surface receptors and applying mechanical stress directly to the receptor using a device to twist the magnetic particle on the cell surface.

#### SPHERO™ Amino Ferromagnetic Particles

Product	Size, $\mu\text{m}$	% w/v	Catalog No.	Unit
Amino Ferromagnetic	4.0-4.5	1.0	AFM-40-10	10 mL

#### SPHERO™ Carboxyl Fluorescent Magnetic Particles

Product	Size, $\mu\text{m}$	% w/v	Catalog No.	Unit
Fluorescent Nile Red Carboxyl Magnetic	0.2-0.3	1.0	FCM-02556-2	2 mL
Fluorescent Yellow Carboxyl Magnetic	1.0-1.4	1.0	FCM-1052-2	2 mL
Fluorescent Pink Carboxyl Magnetic	1.0-1.4	1.0	FCM-1058-2	2 mL
Fluorescent Yellow Carboxyl Magnetic	2.0-2.4	1.0	FCM-2052-2	2 mL
Fluorescent Pink Carboxyl Magnetic	2.0-2.4	1.0	FCM-2058-2	2 mL
Fluorescent Yellow Carboxyl Magnetic	4.0-4.9	1.0	FCM-4052-2	2 mL
Fluorescent Nile Red Carboxyl Magnetic	4.0-4.9	1.0	FCM-4056-2	2 mL
Fluorescent Pink Carboxyl Magnetic	4.0-4.9	1.0	FCM-4058-2	2 mL
Fluorescent UV Carboxyl Magnetic	7.0-7.9	0.1	FCM-7041-2	2 mL
Fluorescent Yellow Carboxyl Magnetic	8.0-8.9	1.0	FCM-8052-2	2 mL
Fluorescent Nile Red Carboxyl Magnetic	8.0-8.9	1.0	FCM-8056-2	2 mL

#### SPHERO™ Carboxyl Ferromagnetic Particles

Product	Size, $\mu\text{m}$	% w/v	Catalog No.	Unit
Carboxyl Ferromagnetic	2.0-2.9	1.0	CFM-20-10	10 mL
Carboxyl Ferromagnetic	4.0-4.9	1.0	CFM-40-10	10 mL
Carboxyl Ferromagnetic	6.0-7.9	1.0	CFM-60-5	5 mL
Carboxyl Ferromagnetic	8.0-9.9	1.0	CFM-80-5	5 mL
Carboxyl Ferromagnetic Particles, Cross-linked, granules, non-uniform	~1-2 $\mu\text{m}$	1.0	CFMX-10-10	10 mL

#### SPHERO™ Fluorescent Carboxyl Ferromagnetic Particles

Product	Size, $\mu\text{m}$	% w/v	Catalog No.	Unit
Fluorescent Nile Red Carboxyl Ferromagnetic	4.0-4.9	1.0	FCFM-4056-2	2 mL

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