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### About Us:

The company "**Hamgaman Sanat Foolad Espadana**" (Hemgaman Steel Industry Company) began its activities in 2008 with the aim of contributing to the growth and development of the steel industry in the country. It has defined its mission in four main areas:

- Supplying raw materials and required alloys for the steel industry.
- Providing electrical and mechanical equipment for this industry.
- Manufacturing the necessary equipment and components for the steel industry.
- Supplying industrial and specialized steels.

The core of this company started its operational activities in the early 1990s as industrial, managerial, and consultancy projects. After two decades of efforts and valuable experiences in this field, it established a company with the trade name "Mohandesi Behbood System Naghshe Jahan" in 2008. Subsequently, with changes in strategies and the scope of its activities, the company continued its work under the trade name "**Hamgaman Sanat Foolad Espadana**" up until today.

We hope that with sincere service, we can take a firm step towards increasing the country's production capacity.



## GRAPHITE

Graphite is one of the most important carbon allotropes that has two types of low and high sulfur graphite. These two types of graphite are highly used in metallurgical industries such as increasing steel hardness, producing industrial electrodes and steel and metal oxides revival by using the carbon oxidation

## CPC- CALCINED PETROLEUM COKE

CPC is the black, solid and porous material that due to the high absorption of carbon, has a high thermal value compared to metallurgy coke.

Usage:

- Charging of carbon in steel and casting industrial
- Aluminum plants
- Refractory and anode industries.
- Slag making in electric arc furnaces



Chemical Composition of Calcined Petroleum Coke (High sulfur Graphite)

Symbol	size (mm)		%C	%S	%Ash	%Vm	
CPC	1	25Kg	98	0.5	0.6	0.6	Min
	5						Max

## GPC: GRAPHITE PETROLEUM COKE

Graphite petroleum coke has high purity of carbon, low sulfur, low ash and porous.

Usage:

- To increase carbon in ductyl cast iron production.
- To increase carbon in steel and alloy steel
- Plastic plants
- Rubber plants



Chemical Composition of Graphite Petroleum Coke (Low sulfur Graphite)

Symbol	size (mm)		%C	%S	Ash%	Vm%	
GPC	1	25Kg	98.5	0.05	0.5	0.5	Min
	5						Max



## FERRO CHROME

Ferro chrome is one of the main agents in ferro alloys industries. Ferro chrome has a high resistance properties of corrosion, thermal, wear, fatigue and oxidation that is used in stainless steel industries.

There are three types of ferro chrome:

1- Low carbon (C=%0.03-%0.15)

Low carbon ferro chrome has corrosion and oxidation resistance properties and is used in stainless steel industries.

2- Medium carbon (C=up to 4%)

3- High carbon (C=6%-8%)

High carbon ferro chrome has high hardness, strength and wear resistant properties that is used in ball bearing and tools productions



Chemical Composition of High carbon Ferrochrome

Symbol	size (mm)	%Cr	%C	%Si	%S	%P	
HC FeCr	10	62	6	1.5			Min
	60	64	8	1.8	0.04	0.04	Max



Chemical Composition of Low carbon Ferrochrome

Symbol	size (mm)	%Cr	%Si	%S	%P	%C	
LC FeCr	10	60					Min
	60	65	1	0.005	0.02	0.1	Max



## FERRO SILICON

Ferro silicon is combination of iron and silicon with 1290-1390<sup>o</sup>C melting range. This additive increases tensile strength, hardness in high temp and elasticity in steel alloys production process.

Usage:

- Deoxidizing
- Achieving the desire combination of steels and cast irons.
- Germinating in gray cast iron
- Graphite electrode producing for welding industries
- FeSiMg and FeSiMn production
- Refractory steel production



Chemical Composition of Ferrosilicon

Symbol	size (mm)			%Si	%Al	%S	%P	%C	
FeSi	0	3	10	72	1.4	0.01	0.04	0.15	Min
	3	10	60	74	2	0.03	0.05	0.2	Max

## SILICON CARBIDE(SiC)

Silicon carbide is formed by silicon 60% and carbon 30-35% that offers a hard chemical compound, superior heat resistance, and high mechanical strength in temperatures reaching 1400 °C.

usage:

- In steel and cast iron production
- Perfect deoxygenation
- Powerful germination
- Melt liquidation increase up to 40%

Other uses of silicon carbide

- Abrasive tools
- Sandpapers
- Metallurgy industries
- Refractory products
- Acid washing units
- Torch nozzle
- Casting low pressure pipes
- Thermocouple protector pipes
- Garbage incinerators
- Ceramic industries



Chemical Composition of Silicon carbide (carborundum)

Symbol	size (mm)		%SiC	%Si	%C	%C <sub>free</sub>	%SiO <sub>2</sub>	%F <sub>e</sub>	%S	
SiC	0	0	88	60	30			0.5		Min
	1	10	92			5	5	0.9	0.15	Max



## FERRO MANGANESE

Ferro Manganese is high consumption metal in steel production industries that increase forming and weld ability properties of steel without any effort on hammering property.

Ferro Manganese is produced by reduction of manganese oxide in blast and electric furnaces.

It is also use as Nickle alternative in stainless steel 200 series and add as steel reviver and cleaner for sulfur elimination in production.

There are three types of Ferro Manganese:

1. Low carbon Ferro Manganese
2. Medium carbon Ferro Manganese that is use to increase welding property, production of steel tools, heat and abrasion resistant steel.
3. High carbon Ferro Manganese which is one of the high consumption Ferro alloys in steel production lines that increase hardness, hard work, tension and mechanical strength properties in steel.



Chemical Composition of Low Carbon Ferromanganese

Symbol	size (mm)	%Mn	%C	%P	%Si	%S	
LC FeMn	10	80					Min
	60		0.5	0.025	0.5	0.03	Max



Chemical Composition of Medium Carbon Ferromanganese

Symbol	size (mm)	%Mn	%C	%P	%Si	%S	
MC FeMn	10	78					Min
	60	81	1.5	0.2	1.5	0.03	Max



Chemical Composition of High Carbon Ferromanganese

Symbol	size (mm)	%Mn	%C	%P	%Si	%S	
HC FeMn	10	75	6	0.15			Min
	60	78	8	0.25	1.5	0.03	Max



## FERRO SILICON MANGANESE

It has properties similar to Ferro Manganese and Ferro Silicon that could be substitute of them. It has high deoxygenize capability compare to Fe MN and Fe Si that caused the result of Manganese silicate from steel melt, also eliminate of impurity like Sulfur, Phosphors and Nitrogen from produced steels that increase hardness, toughness, corrosion resistance, decrease carbon suability in steel, austenite phase stability, reduction of heat transmission and low attemptability to work.



Chemical Composition of Ferrosilicon Manganese

Symbol	size (mm)			%Mn	%Si	%C	%S	%P	Min	Max
	10	60	64							
FeSiMn	10	60	64	14	16	2	0.03	0.3		
	60	64	16							

## FERRO SILICON MAGNESIUM

Ferro silicon magnesium has transform sheet graphities to spherical shape to produce of ductile iron and increase hardness compare to gray iron.

It is also caused to increase impact of resistance, toughness and hardness alongside of carbide decreasing in foundry thin sections, machining improvement, increase ferrite and decreasing steel brittleness and heat treatment charges.

This alloy use in steel cleaning and purification, additive in stainless steel, silicon steel and carbon steel too.



Chemical Composition of Ferrosilicon Magnesium

Symbol	size (mm)			%Si	%Mg	%Ca	%Re	Min	Max
	A	B	C						
FeSiMg	2	6	10	44	5.5	0.8	1.1		
	6	15	35	47	7	1.2	2		





## FERRO TITANIUM

Ferro titanium is produced by melting titanium scrap with the low carbon iron in an induction furnace. Ferro titanium compared with pure titanium has some more advantages like: better dissolvability, low melt point, high density and lower price.

That caused steel refining (reacted with sulfur, carbon, oxygen and nitrogen and separated it in melt as slag type).

Usage:

- Upgrade steel structure (by grain-size control)
- De-graphitization of gray cast iron
- Use in automobile, aerial and ship building industries



Chemical Composition of Ferrotitanium

Symbol	size (mm)	%Ti	%Al	%C	%Mn	%Si	%P	%S	
FeTi	5	70	1						Min
	50	75	3	0.09	0.2	0.2	0.1	0.014	Max

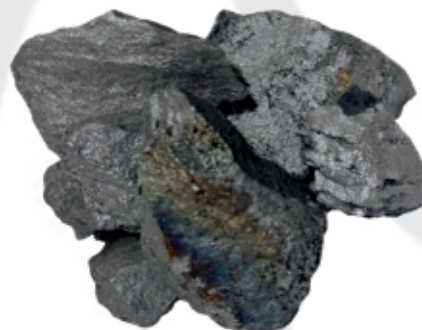
## FERRO MOLYBDENUM

Ferro Molybdenum is formed by Combining Iron and Molybdenum.

Ferro Molybdenum is one of the important agent in steel alloys. Add ferro molybdenum in steel alloy production will be increased steel Hardness, Corrosion resistance (in austenite and biphasic of stainless steel), weldability, fatigue, creep and wear resistant, also increase hydrogen crack resistance.

Usage:

- Production of steam boilers and pressure vessels.
- Molybdenum super alloys production
- Manufacturing of protective layers in automobile and aerial industries.
- Use in construction steel, car parts, military industry, drills, generators and petro chemical industries.
- Use in automobile, aerial and ship building industries



Chemical Composition of Ferromolybdenum

Symbol	size (mm)	%Mo	%Fe	%Cu	%C	
FeMo	10	60	34	0.5		Min
	60	65	35	1	0.1	Max



## FERRO VANADIUM

Ferro Vanadium is formed by combining iron and 35%-85% content of vanadium.

Ferro Vanadium is a universal hardener, anti-corrosive and strengthener additive in steel industries. It is also an additive to the ferrous metals production process.

Usage:

- Increase hardness, strength, anti-corrosive and abrasion resistance in steels, high-strength low-alloy (HSLA) steels and steel tools.
- In production of gears, axis, crankshaft, medical tools, rails, oil pipelines, airplane engine and frame work and low weight cars.



Chemical Composition of Ferrovanadium

Symbol	size (mm)	%V	%Al	%S	%P	%C	
FeV	10	80					Min
	70		0.35	0.71	0.047	0.092	Max

## FERRO NIOBIUM

Ferro Niobium is formed by combining iron and 60%-70% content of niobium.

Ferro Niobium is the number one agent used for high-strength low-alloy (HSLA) and advanced high-strength steel (AHSS) Due to its effect in the strength and toughness of steel production.

Usage:

- Increase steel resistance of high temperature, corrosion, oxidation, creep and weldability.
- Decrease steel high temperature erosion.
- Use in carbon steel, stainless steel, HSLA, AHSS production.
- Use also in construction, bridge building, ship building, oil and gas pipelines, turbine blades and automobile manufacturing.



Chemical Composition of Ferro niobium

Symbol	size (mm)	%Nb	%Al	%Si	%P	%C	
FeNb	10	63	2	2.5			Min
	60	65	3	3	0.2	0.3	Max



## GRAPHITE ELECTRODE

Graphite electrodes have a variety of advantages such as high thermal conductivity, low electrical resistance, high mechanical strength, good chemical stability, and low thermal expansion. These properties make them ideal for use in electric arc furnaces to melt scrap steel and produce new steel. The demand for graphite electrodes has significantly increased with the growing steel industry worldwide.

Graphite electrode is an important high-temperature conductive material for arc furnace steel making, that is produced by a series of processes such as kneading, molding, baking, impregnation, graphitization and machining, using petroleum coke and needle coke as aggregate and coal tar as binder.

Additionally, graphite electrodes also find applications in the production of silicon metal, phosphorus and other non-ferrous metals. With the increasing demand for sustainable and green solutions, graphite electrodes made from recycled materials are gaining popularity in the industry.

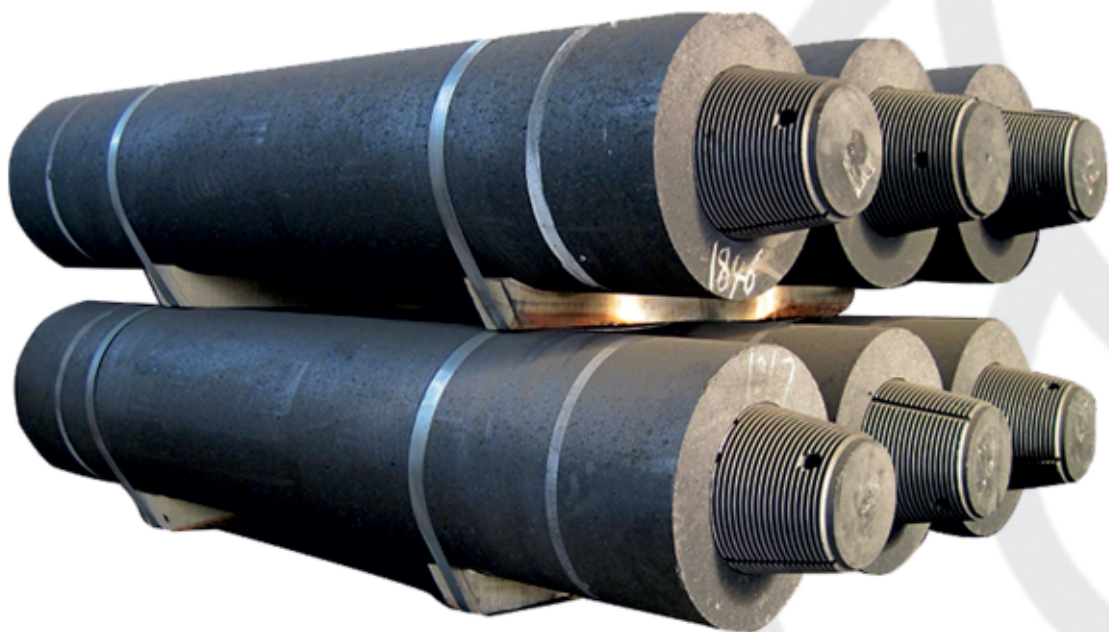
These types of Graphite electrode are most familiar:

RP Graphite electrodes, HP Graphite electrodes and UHP Graphite electrodes.

1. RP type is mainly used for regular electric arc furnace to smelt scrap steel, silicon and yellow phosphorus.
2. HP Graphite electrode is used for high power electric arc furnace, with the current range of 18-25A/cm<sup>2</sup>.
3. UHP Graphite electrode is used for the scrap steel in electric arc furnace industry.

Graphite electrode can suffer up to 3000°C temp.

Electric arc furnace is a type of furnace that uses an electric arc to generate heat needed for melting or alloying metals. This process involves the use of electrodes that conduct high currents at low voltage. The amount of electrode consumption is affected by changes made to the furnace, such as adjustments in voltage or current.





## ELECTRODE PASTE

Electrode paste is one of the materials used to manufacture Soderberg electrodes in Submerged Arc Furnaces (S.A.F). To produce these electrodes, a mixture of sulfurized graphite and a special adhesive is poured into an iron shell. Then, a process called sintering is performed to create the desired electrode.

It should be noted that electrode paste possesses important properties such as high electrical and thermal conductivity, good heat resistance, uniform composition, high coefficient of thermal expansion, adequate mechanical strength, and high density.

Moreover, the use of Soderberg electrodes in S.A.F furnaces is much more cost-effective compared to graphite electrodes. Therefore, they are commonly used for producing ferroalloys such as ferrosilicon, ferromanganese, ferrochromium, and Ferro silicomanganese.



Specification of Electrode Paste

Item	Unit	Value
Ash	%	3 Max
Volatile Matter	%	10-15
Compressive Strength	MPA	18 Min
Specific Resistance	$\mu\Omega\text{m}$	68 Max
Density	$\text{g/cm}^3$	1.46 Min
Carbon Content	%	85 Min
Porosity	%	30 Max
Plasticity	%	35-40



## Lead (pb)

Lead is a soft ductile, malleable and dense metal with silvery or grayish color. Lead oxidizes quickly, applying a dull gray coating so it protects the metal from further corrosion.

Usage:

- in acid batteries because of high resistant against sulfuric acid
- bearing
- Scales
- Cathode ray tubes
- Pigments
- Chemical plants
- Cable Coatings



## Zinc(Zn)

Zinc is one of the most important and widely used metals.

It has a corrosion-resistant coating on the surface of iron or steel subjects.

It develops a thin gray oxide film, which controls deeper corrosion of the metal.

Usage:

1. Galvanizing, protection of steel and iron against air exposures.
2. Combined with copper (brass) and other metals, which are used in automobiles, electrical parts and household fixtures industries.
3. As a compound that mainly used by paint, chemical, rubber and agricultural industries.



## Tin

Tin is a rather soft and formable metal with a silvery color. Tin used in industrial application as a metal, and as compound in chemical. It is used mostly in combination with other metals as an alloy or coating.

Usage:

- Tin plate
- Polder Alloy
- Tin Coating
- Making bronzes
- Fusible Alloys



## Nickel

Nickel is a silvery-white metal that is widely used in various industries due to its unique chemical and physical properties. Here are some key facts about nickel in industries:

1. Nickel is primarily used in the production of stainless steel, which accounts for about 70% of global nickel consumption. It is added to steel to enhance its strength, durability, and resistance to corrosion.
2. Other major uses of nickel include the production of rechargeable batteries, non-ferrous alloys, electroplating, and catalysts for petrochemical processes.
3. Nickel is highly resistant to corrosion and oxidation, making it an ideal material for use in harsh environments such as offshore oil rigs and chemical processing plants.
4. The demand for nickel is growing rapidly due to increasing industrialization, urbanization, and infrastructure development worldwide.
5. However, nickel mining and processing can have significant environmental impacts, such as soil and water contamination, deforestation, and greenhouse gas emissions. There is a growing trend towards sustainable nickel production and recycling to minimize these impacts.





## Billets:

Steel billets are produced from primary steels or scrap steels. Billets are used as raw material or feedstock in forging, rolling, extrusion and other operations of metal processing.

Most familiar types are 3SP and 5SP that depend on the customer's requirements and use it in their operations process.

Produce dia. Size: 100×100mm to 150×150mm, length: 6 and 12 meters



## FORGED & FOUNDRY GRINDING MEDIA STEEL BALLS FOR BALL MILL

Round steel balls are produced in forged and cast iron type and various dimensions which depend on required circumstances will be produced.

The forged and cast iron media balls can be used for many different applications for instance: gold mining, cement factories, oil processing and large scale industrial applications

The media steel balls can be composed of a variety of materials, including carbon steel, stainless steel, chrome steel and non-metallic material like ceramics.

Forged steel balls in 70Cr2 composition have several characteristics like: high abrasion and impact resistance, belonging to proper toughness, hard steady surface, perfect sphere and martensitic fine grain structure.

Cast iron balls is produced by white and ductile iron that can be used for cement plants and mineral industries to produce require powders grading.






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