Technology Summary: Coke Powder Use in Pig Iron Production

Opportunity Statement

Generally, iron manufacturing involves reducing its ore to either sponge iron or pig iron. Sponge iron is prepared by a direct reduction method, which uses a reducing gas produced from natural gas or coal. However, the iron produced by this technique is prone to rusting. Also, since the process is slow, it is not suitable for producing large amounts of iron. Pig iron is produced using a blast furnace technique that uses iron ore and coke (reducing agent) as raw materials. In the process to prepare raw coke for pig iron production (crushing and proper sizing), up to 25% of the coke is lost as fine coke powder. Although coke powder has the same physicochemical properties as that of coke, it cannot be used because the extremely small particle size of the coke powder negatively influences the air permeability of the blast furnace charge column.

Therefore, methods have been developed to allow the use of coke powder for iron production. Under these approaches, the coke powder is agglomerated with iron ore using a binder to prepare ferrous coke briquettes, which then act as a raw material in the blast furnace.

Problem

The current techniques available for preparing ferrous coke briquettes use high-temperature processes that are energy-intensive and produce a product with undesirable mechanical properties. Low-temperature strength, which is required to withstand mechanical impacts during transportation, is not achievable using current methods of coke powder briquette production. In addition, at high temperatures, the binders used for binding the coke powder and iron ore get consolidated (i.e., form a lump), thus negatively affecting the binding properties.

Therefore, there is a need for a solution that addresses these current barriers to the full use of coke powder for pig iron production.

360ip's Partner Solution

360ip's partner has developed a novel technology that overcomes the disadvantages of conventional techniques for producing ferrous coke. The technology uses a novel binder consisting of an organic polymer, silical sol or silica gel, water and a stabilizing agent for agglomerating the coke powder and iron ore. Furthermore, a ***cold*** briquetting technique is employed for the agglomeration, thereby simultaneously providing high- and low-temperature strength, resulting in the ability to withstand mechanical impacts and dropping during transportation, thermal shock, mechanical squeeze, friction and thermal load.

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Other advantages include:

- Cost efficiency (low power consumption due to cold briquetting)
- Environmental friendliness (no secondary pollution due to cold briquetting)
- Good moldability and low impurity content (enhancement in the properties provided by binders)

The technology offers different pathways (provided in the table below) for the preparation of the binder.

Parameter for preparation of binder while preparing ferrous coke	Embodiments			
	1st	2nd	3rd	4th
Raw materials for binder	SHN, Silica sol	SHN, Silicasol	Sodium carboxymethyl cellulose, Silicasol	Sodium carboxymethyl cellulose, Silica gel
Ratio of raw materials for binder and water	1:5:12	1:6:11	1:6:12	1:7:12
Stabilizer	NaOH	NaOH	NaOH	KOH
Amount of stabilizer (%)	0.2	0.2	0.2	0.3
Temperature (°C)	180	185	190	190
Vapor pressure (Mpa)	1.3	1.2	1.2	1.3
Reaction time (Hr)	2.5	3	2.5	3

Patents

360ip's partner has filed two patent applications on this invention.

360ip is seeking interested parties for the licensing, further development and commercialization of this technology-based solution.

For additional information, contact:
licensing@360ip.com