China’s Graphite Electrode Production and Its Implications

Prof. Dr Mark Shujun Ma

Ark Of China Limited  Founder & Chairman
CIMM Group Co Ltd  Founder & Chairman
There is a Crack in Everything, That's How the Light Gets in.

Leonard Cohen
Some Data about Prof Dr Mark Shujun Ma

China Association of SMEs, Vice Chairman
China Association of SME Global Cooperation Center, CEO
Liaoning Industrial Internet Industry Alliance, Chairman

- 218 visits to India
- 300+ Steel Works
- 129 Countries & regions
- 200+ Mines
- 20,000+ Manufacturers
- 500+ Project designing company
- 100+ Aluminum plants /Copper smelters

© 2018 Ark Of China, All Rights Reserved. Highly confidential. Any form of use is prohibited without permission.
Brief introduction of Prof Dr Mark Shujun Ma

- United Nations Industrial Development Organization Expert for BRICS SMEs e-Commerce project
- The Outstanding Builder of the Socialist Cause With Chinese Characteristics
- China Association of Small & Medium Enterprises, Vice-Chairman
- China Private Economy Research Association, Vice Chairman
- Liaoning Overseas Exchange Association, Chairman
- Liaoning Industrial Internet Industry Alliance, Chairman
- Member of the CPPCC of Liaoning Province
- Vice Chairman, Liaoning Federation Of Industry & Commerce
- China International Chamber Of Commerce Dalian Chamber Of Commerce, Vice-President
- Member of the Advisory Committee of Dalian Municipal Government
- Dongbei University Of Finance and Economics, Professor
Dr Mark Ma has 27-years Experience in Steel-making industry

- Dr Mark is a well-known Metallurgist
- Dr Mark has been in Metallurgical industry for over 27 years, having participated a lot of Steel-making projects in BF, EAF, Continuous Casting, providing services including designing, transformation, installation, commissioning, production, operation and maintenance in the metallurgical industry, with in-depth understanding of the steel-making industry, especially EAF steelmaking and Ladle Refining, home and abroad.
- Dr Ma has been working for 27 years in the carbon industry, knows very deeply all the carbon and graphite electrodes plants worldwide.
- Dr Mark is widely respected and regarded as the “Guru” both in Graphite Electrodes and Refractory industry in China.
Foreword— Starting with the price-soaring of graphite electrodes

Since early 2017, great changes have taken place in GE market with shifting from situation of dull sale, low price and severe losses in previous years to the shortage in supply and price hikes. The previous buyer's market has been replaced by the current seller's market. The soaring price in Chinese GE market then drives the surging price around the global. Since Oct. 2017, GE market has witnessed the pull-back in price followed by rebounding price; in the first half of 2018, GE market continued its hot situation as it was in 2017--despite repeated shocks and price fall, GE price, overall, has remained at a relatively high level compared with historical levels, and it is unlikely to return to the level of pre-2017.
WHAT happened in GE industry?
China’s Graphite Electrode Production And Its Implications

Content

1. Why is the price of graphite electrodes soaring

2. China’s Graphite Electrode Production Capacity & Volume

3. Global Steel Industry’s Demands for Graphite Electrode

4. Import of Needle Coke Restricts GE Production in China

5. Implications to Global Steel Industry

6. Main Problems

7. CIMM Solutions – Global Open GE Ecosystem

© 2018 Ark Of China, All Rights Reserved. Highly confidential. Any form of use is prohibited without permission.
Why is the price of graphite electrodes soaring?

Only one reason – Serious Shortage of supply

The fundamental reason behind the price soaring is the serious shortage in GE supply and the increasing demands.
Major Reasons for serious shortage of GE supply

1. GE manufacturers have suffered long-term losses, leading to significant production capacity reduction.
2. The implementation of China's supply-side reform and environmental laws and regulations, especially the "2+26" cities environmental protection supervision, has led to the increasing of production costs and low utilization ratio of GE production capacity. About 200,000 metric tons of GE capacity have been shut down due to the failure to meet the emission standard under environmental protection supervision.
3. Tight supply in raw material: petroleum-coke production is floating downward while needle coke production capacity is seriously inadequate with difficulty to import.
Major Reasons for newly-increased demands in steel industry

Influenced by cutting of overcapacity, steel industry has witnessed price hikes and sharp rise in benefits; and removal of substandard steel provides space for the increasing EAF which further drives the rising demand for graphite electrodes.

Due to the cost advantages of EAF short-process steelmaking, EAF steelmaking shows increases in proportion.
Content

1. Why is the price of graphite electrodes soaring

2. **China’s Graphite Electrode Production Capacity & Volume**

3. Global Steel Industry’s Demands for Graphite Electrode

4. Import of Needle Coke Restricts GE Production in China

5. Implications to Global Steel Industry

6. Main Problems

7. CIMM Solutions – Global Open GE Ecosystem
2. China’s Graphite Electrode Production Capacity & Volume

Actual Total GE Production Volume in China (2008-2018.6)

There are 46 GE manufacturers in China with a total production capacity at 550,000 tons (+/- 10%). From 2008 to 2018, the actual total output of GE fluctuates between 480,000 and 680,000 tons, accounting for 46% of the global GE output.
In 2017, there are about 46 GE manufacturers in China with 1.1 million tons of nominal capacity.

Among the 46 GE manufacturers:
① 21 enterprises with total capacity of 473,000 tons have been shut down;
② Some are partially stopped
③ Some have reduced production seasonally

Therefore, the total effective capacity is only 530,000-630,000 tons.
2. China’s Graphite Electrode Production Capacity & Volume

2010-2017 Total Global GE Production Capacity

2010-2017 Total Global GE Production Capacity (unit 1000mt)

- 2010: 1,578
- 2011: 1,652
- 2012: 1,624
- 2013: 1,579
- 2014: 1,512
- 2015: 1,395
- 2016: 1,303
- 2017: 1,438

© 2018 Ark Of China, All Rights Reserved. Highly confidential. Any form of use is prohibited without permission.
The GE production capacity of world’s major carbon enterprises (excluding China) is about 900,000 tons, and the actual annual output should be about 700,000 tons.
Comparison between Global GE Production Capacity & that of China

Comparison between Global GE Production Capacity and China's GE Production Capacity (unit 1000mt)

- 2010: Global 1,600, China 38.7%, Ratio 43.8%
- 2011: Global 1,400, China 40.6%
- 2012: Global 1,200, China 36.9%
- 2013: Global 1,200, China 36.7%
- 2014: Global 1,200, China 39.7%
- 2015: Global 1,000, China 37.3%
- 2016: Global 1,000, China 38.4%
- 2017: Global 1,600, China 43.8%

© 2018 Ark Of China, All Rights Reserved. Highly confidential. Any form of use is prohibited without permission.
Content

1. Why is the price of graphite electrodes soaring
2. China’s Graphite Electrode Production Capacity & Volume
3. **Global Steel Industry’s Demands for Graphite Electrode**
4. Import of Needle Coke Restricts GE Production in China
5. Implications to Global Steel Industry
6. Main Problems
7. CIMM Solutions – Global Open GE Ecosystem

© 2018 Ark Of China, All Rights Reserved. Highly confidential. Any form of use is prohibited without permission.
3. Global Steel Industry’s Demands for Graphite Electrode

Main Usages & Demands of GE

The world demands for GE amounts to 1.6-2.0 million tons annually

For steelmaking: 61%

Though the world's GE nominal capacity is around 1.6 million tons, its effective capacity is only 1.1 million tons annually due to various reasons, much lower than the global total demands of over 1.67 million tons, leading to a huge supply gap (especially for UHP GE).
Consumption Share of GE Downstream Industries

The downstream consumption of GE is mainly in steel industry, followed by metal silicon, yellow phosphorus, corundum, calcium carbide, etc. The proportion used in steel industry accounts for about 61%, based on which it can be calculated that global demand for GE is 1.67 million tons.

For steel industry, its main demand is HP and UHP GE, among which the output of high-quality UHP GE is seriously inadequate.
Graphite Electrode Is A Kind of Strategic Rare Energy.

—— Dr. Mark Shujun Ma
EAF steelmaking is dependent on Graphite Electrode

There is no substitute for Graphite Electrode to be used in EAF steelmaking. With the increasing of EAF steelmaking, the demand for GE will increase in a large scale.
3. Global Steel Industry’s Demands for Graphite Electrode

1950-2017 Global Crude Steel production volume

1950-2017 Global Crude Steel production volume (million tons)
3. Global Steel Industry’s Demands for Graphite Electrode

Top 10 steel-producing countries

- China: 49.2%
- Japan: 6.2%
- Turkey: 2.2%
- Korea: 4.2%
- Russia: 4.2%
- USA: 6.0%
- India: 6.0%
- Brazil: 2.0%
- Germany: 2.6%
- Italy: 1.4%
- Others: 17.1%
Total global EAF Steel volume: 407.195 million tons

Total demand for GE is about 1.22 million tons
3. Global Steel Industry’s Demands for Graphite Electrode

Share of EAFs in Global Steel Production is about 25-35%

In the world's crude steel production, the proportion of EAF steel accounts for about 25-35%.

In 2016, the total output of EAF steel is 407.2 million tons, accounting for 25% of the total output in that year.
3. Global Steel Industry’s Demands for Graphite Electrode

China has the largest steel output but the lowest EAF Steel ratio in the world

As the largest steel producer in the world (accounting for 50% of the total), China unexpectedly ranked last in its EAF steelmaking.

Therefore, China reserves huge development space for EAF steelmaking, and it is predicted that the domestic market demand for GE will continue to increase.
By the end of 2018, about 56 new EAFs will be established with a total capacity of about 60-70 million tons. According to the NDRC's plan, China's EAF steel output is expected to rise to about 14% of the total by 2020, and 30% by 2030.
China's Steel Industry's Demand for GE is Expected to Reach 638,000 tons in 2030

At present, the world's total output of crude steel is 1.69 billion tons and as per experts' prediction, it will grow to 2.8 billion tons by 2050 with the share of EAF steel reaching 70%.

Currently, China accounts for about 50% of the global crude steel production, but its share of EAF steel is only about 10%, the lowest in the world.

In the context of China’s supply-side reform and structural adjustment, as well as environmental supervision, developing EAF short-process steelmaking has been repeatedly emphasized and required by the authorities. According to the NDRC’s (National Development and Reform Commission) planning, China’s EAF ratio will reach 30% by 2030. In this process, steel industry’s demand for GE, especially for the UHP grade, will continue to increase and reach 638,000 tons in 2030.
3. Global Steel Industry’s Demands for Graphite Electrode

The export volume of Chinese GE in the past 30 years

The export volume of Chinese GE in 1987-2017 (unit 10000mt)
3. Global Steel Industry’s Demands for Graphite Electrode

2009-2017 Major export market of Chinese GE

2009-2017 major markets of Chinese GE exports
(above 1000mt/year for 9 consecutive years)
Content

1. Why is the price of graphite electrodes soaring
2. China’s Graphite Electrode Production Capacity & Volume
3. Global Steel Industry’s Demands for Graphite Electrode
4. Import of Needle Coke Restricts GE Production in China
5. Implications to Global Steel Industry
6. Main Problems
7. CIMM Solutions – Global Open GE Ecosystem

© 2018 Ark Of China, All Rights Reserved. Highly confidential. Any form of use is prohibited without permission.
In the past two years, with the rapid development of the lithium-ion battery industry, the market for lithium battery anode materials in China has grown significantly. A large number of manufacturers have begun to use needle coke to produce anode materials because of their low cost, high gram capacity and overall stable performance. And the annual consumption volume has been increasing year by year.
Chinese domestic Needle Coke production volume

China's Domestic Needle Coke Production Volume (unit 1,000 mt)

- 2014: 63.00
- 2015: 40.00
- 2016: 56.00
- 2017: 149.20
- 2018Q1Q2: 160.80
There is a big quality gap between Imported NC & domestic NC

But due to the late industrialization of needle coke, China is 30 years later than Japan and 60 years later than the United States in the development of needle coke production technology. There is a big gap in Needle Coke production technology and NC quality between imported needle coke and domestically-made needle coke.
4. Import of Needle Coke Restricts GE Production in China

NC production volume of World’s major NC Producers

NC Production Volume of World's Major NC Producers & their NC Export Volume to China in 2017
(unit 1,000mt)

- Phillips 66 (UK): Production 230, Export 82
- Phillips 66 (USA): Production 130, Export 0
- Seadrift (USA): Production 100, Export 0
- JX (Japan): Production 50, Export 5.5
- Mizushima Oil: Production 50, Export 5.5
- C-CHEM: Production 50, Export 47
- Mitsubishi Chemical: Production 60, Export 0
- PMC (Korea): Production 30, Export 25
4. Import of Needle Coke Restricts GE Production in China

China’s NC demands in GE production & NC import volume

China's NC Demands in GE production industry & NC Import Volume (unit 1,000mt)

- NC Demand
- NC Import

<table>
<thead>
<tr>
<th>Year</th>
<th>NC Demand</th>
<th>NC Import</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>270.52</td>
<td>54.20</td>
</tr>
<tr>
<td>2015</td>
<td>282.82</td>
<td>67.70</td>
</tr>
<tr>
<td>2016</td>
<td>254.88</td>
<td>115.60</td>
</tr>
<tr>
<td>2017</td>
<td>317.08</td>
<td>190.50</td>
</tr>
<tr>
<td>2013Q1</td>
<td>180.62</td>
<td>111.00</td>
</tr>
</tbody>
</table>
4. Import of Needle Coke Restricts GE Production in China

Jan-Jun 2018 NC import volume into China

2018 Jan-Jun NC Import Volume into China (unit: mt)

- **UK**: 41,556
- **Japan**: 16,646
- **Korea**: 33,661
- **Germany**: 4,814
- **India**: 2,550
- **Sweden**: 2,378
- **Norway**: 814
- **USA**: 614
- **Other**: 175
- **Other**: 142
- **Other**: 20
- **Other**: 39

© 2018 Ark Of China, All Rights Reserved. Highly confidential. Any form of use is prohibited without permission.
Lack of best-quality Needle Coke is bottle-neck for GE production

- Limited NC production volume in China
- China could not get the best-quality NC for GE nipple production
- Li-ion Anode material production grabs the partial raw materials for GE production
Content

1. Why is the price of graphite electrodes soaring
2. China’s Graphite Electrode Production Capacity & Volume
3. Global Steel Industry’s Demands for Graphite Electrode
4. Import of Needle Coke Restricts GE Production in China
5. Implications to Global Steel Industry
6. Main Problems
7. CIMM Solutions – Global Open GE Ecosystem
5. Implications to Global Steel Industry

Implications to Global EAF Steel industry

China’s graphite electrodes account for about 45% of global GE production, China’s graphite electrode production greatly impacts the global GE market and global EAF Steel industry.

Pricing

- The price of China's graphite electrode leads the global graphite electrode market.

Steel production cost

- The price increase of China’s GE increases the EAF steel production cost, but this cost increase is relatively low as compared with steel profit because the unit consumption per ton of steel is only 2.5kg of graphite electrode.

To Melt or Not

- To melt or not to melt is an important issue for EAF steel mills when short supply of graphite electrodes continues in 3-5 years.

Support to global EAF steel industry

- China exports about 200,000mt graphite electrodes annually. With the rapid development of EAF steel-making process in China itself, the export volume of China’s GE will decrease significantly, influencing about 84 million tons of EAF Steel production outside China.
Content

1. Why is the price of graphite electrodes soaring

2. China’s Graphite Electrode Production Capacity & Volume

3. Global Steel Industry’s Demands for Graphite Electrode

4. Import of Needle Coke Restricts GE Production in China

5. Implications to Global Steel Industry

6. Main Problems

7. CIMM Solutions – Global Open GE Ecosystem
There are too many no-brand, one-workshop small enterprises while there are too few branded, up-to-scale enterprises in Chinese GE industry.
6. Main Problems in China’s GE industry

Lack of internationalized enterprises

Most of GE manufacturers are with conservative thoughts, lying in the huge domestic market and the super-high-price hotbed, without aggressive thinking and without the power/ability of internationalization.
6. Main Problems in China’s GE industry

Short supply of high quality UHP GE

High-quality UHP graphite electrode will be in short supply in the coming 5 years or long term.

Attention

In 5 years, with short supply of high-quality UHP Graphite Electrode, please stock........
GE producers need to control the cost of raw materials

The soaring price of graphite electrode since 2017, after over one year’s market transmission, has caused the price of raw materials to double continuously. As GE price has dropped after several rounds of adjustment, if the price of raw materials continues to rise, it will affect the healthy development of the whole GE industry. Although certain profit margin remains in GE production, after several rounds of price adjustment, the profit margin has been greatly squeezed. Therefore, it is suggested that GE manufacturers should control the cost of raw materials and achieve strategic cooperation with raw material suppliers, or plan their own raw materials production.
Insufficient capacity in the core process of GE production

There are many GE producers in China but most of them are not full-process manufacturers, lack of Forming process, or Baking process or Graphitization process, etc.
Seasonal GE production limitation every year

GE Production Limitation in “2+26” Cities under air pollution supervision: In the heating period (from Nov 15th to Mar 15th of the following year), the GE production in these areas will be limited, due to lack of natural gas (The problem of natural gas cannot be solved within 3 years).
Content

1. Why is the price of graphite electrodes soaring
2. China’s Graphite Electrode Production Capacity & Volume
3. Global Steel Industry’s Demands for Graphite Electrode
4. Import of Needle Coke Restricts GE Production in China
5. Implications to Global Steel Industry
6. Main Problems
7. CIMM Solutions – Global Open GE Ecosystem
西姆全球石墨电极生产及技术服务生态系统

CIMM Global GE Production & Service Open Ecosystem Platform

自产
10万吨
In-house
100,000mt

OEM
10万吨
OEM
100,000mt

原料
20万吨
CPC & NC
200,000mt

Shanxi 30000mt
Europe 30000mt
India 30000mt

China

Fushun No2

Solution 1
CIMM Carbon Alliance (CCA) Europe UHP GE project
Production capacity of the project

**Planned capacity:** first phase 30000-60000t/a with raw material preparation and forming reserved for 60000t/a in the second phase. The production can increase to 100000 in the 3rd phase. When the first and 2nd phase has been operating smoothly and still market prospective expansion. The following raw material and production utilities is based on 30000mt Production.

**Products specification:** UHP 600, 700, 750;

**Length:** 2400~2800mm
The benefits of CCA Europe UHP GE project to customers

- Excellent quality of UHP Graphite Electrode made from needle coke of European/USA producers

- Stable supply of UHP GE to assure EAF stable operation of EAF steel mills

- Reasonable international-market prices (instead of the higher prices in Chinese domestic market) to lower the steel production cost of EAF steel mills
CIMM Global GE production & Technical Service Open Ecosystem

- Raw material enterprises
- Equipment plants
- Graphite electrode plants
- Refractory plants
- Steel plants
- Other users
- Financial
- Banks
- Sinosure
- Engineering design companies
- Construction and installation
- Technology R&D
- Talents
- Universities & colleges
- Logistics & warehousing
- Servicing enterprises

CIMM Global GE production & Technical Service Open Ecosystem

- Raw materials procurement and distribution platform
- Domestic high quality raw materials procurement and distribution center
- Imported needle coke procurement and distribution center
- Global GE trading platform
- Logistics, financing and insurance service system
- CIMM domestic GE plants
- CIMM oversea GE plants
- CIMM OEM GE plants
- CMM Fushun CPC plant
- Big data analysis and application System of Global steelmaking enterprises EAF
- Big data analysis system of Graphite electrode production enterprise purchase, sale and storage
- Global after-sale service system
Big-data Analysis Platform concerning global EAF steelmaking

Global EAF Steelmaking Industry market

Supply BD
- Chinese Production Capacity
- World Production Capacity
- New Production Projects
- Producer’s Stocks

Big Data platform for global EAF steel making
- Steel scrap
- Ferro alloy
- Power price
- Salary
- Electrode
- Refractories
- …

Demand BD
- Domestic Demand
- World Demand
- Export Data
- Import Data

Market predicting based on Big Data analysis

Online supply-demand matchmaking
Global EAF Cooperation Platform to be launched

Graphite Electrodes
online bidding platform
Serving 217 Steel Mills in the world

CIMM Group serves the world’s 217 steelmaking enterprises. The major customers includes ArcelorMittal, OUTOKUMPU, RIVA GROUP, MEGASA, CELSA, RHI, GERDAU, SIMEC, JINDAL, CSN, NLMK, MMK, KARDEMIIR, SAIL GROUP, JINAL, TATA, ESSAR, POSCO, HYUNDAI and etc.
Global market and “10111” localized service

We set up sales and after-sales team overseas to ensure the quality of service and provide localized service to our customers.

“10111” is interpreted as follows:
10 - means “within 10 kilometers”. 1 - means “within 1 hour”. 1 - means service is available one whole day around the clock. 1 - means service is available one whole year in all 365 days.
The offline service terminal is established within 10 km to key customers that is reachable within 1 hour, providing pre-sale and after-sale service around the clock.
### Vision in 2050

#### In 2017
- 1.69 billion tons of steel
- EAF ratio 40%
- 1.1 mil. tons GE capacity

#### In 2050
- 2.80 billion tons of steel
- EAF ratio 70%
- 6 million tons GE demand
JOIN US

Co-construct + Share

New Future  New Life

Contact details:
Mark    +86  186 2428 6999   markma@arkofchina.com
Karen   +86  138 4112 0187   karen@arkofchina.com