



Progress and Green Development of Henan Refractory Industry

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ISR-2024, Chengdou, Oct. 15-18, 2024

Outline

- 1. Henan's Refra. Industry Dev.**
- 2. Main achievements of HNRI**
- 3. Some works of AHRI**
- 4. Problems and dev. Directions of HNRI**
- 5. Summaries**

1. Henan's Refra. Industry Dev.

- **Period of Initial Dev.**
(1952-1983)
- **Period of Fast Dev.**
(1984-2010)
- **Period of Stable Dev.**
(2011-present)

1.1 Period of initial dev. of Henan (1951–1983)

- ◆ The initial foundation of refra. factory: Jiaozuo (1952), Yuxian (1952), Dengfeng (1955), Luoyang (1958), Mixian (Xinmi, 1958), Gongxian (Gongyi, 1964), etc. Luoyang Institute of Refra. Research (1963)
- ◆ The number of refra. factories in 1983 was 151, **state-operated (17), township collective enterprises (134).**
- ◆ The total production of HNRI was about 0.5 mts in 1983.
- ◆ Refractory products: Clay based: 70-72%; Bauxite based: 10-12%; Magnesia based: 5%; dolomite brick: 5-7%; Silica brick: 4%, others: 2% (in 1983)

1.2 Period of fast dev. (1984–2010)

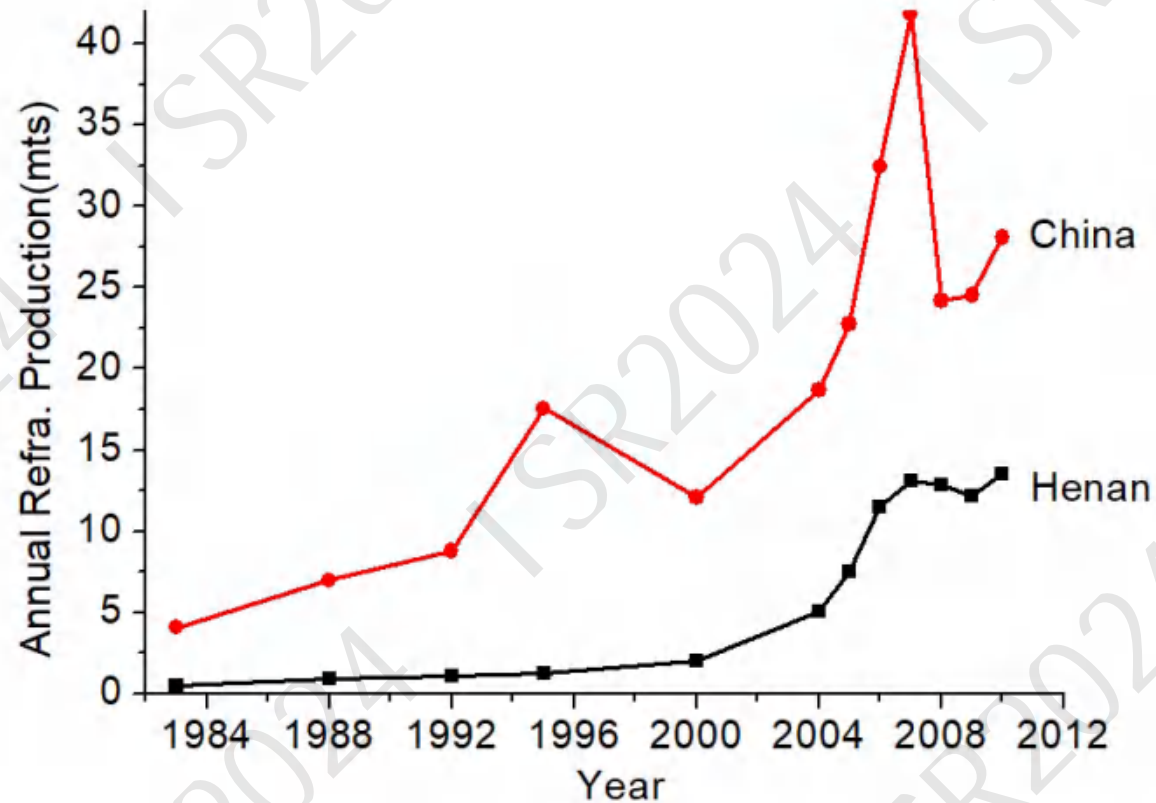


Fig. 2 Annual Production of Refractories in Henan (1983-2010)

HNRI has remarkably developed since 1984 to 2010.

● Rapid Upsurge of Private Enterprises

- The number of enterprises has increased significantly from 151 in 1983 to about 1500 in 2010.**
- Annual Production was increased from 0.5mts to 13mts.**
- Varieties of products have been further improved; Product materials have been developed from a single oxide based to oxide and non-oxide composites.**
- Billions of Investments have been conducted, the automatic levels of equipment were greatly improved.**
- R & D was also enhanced.**

Product Quality and Service Performance Upgraded

——more than 95% of important refra. Products were supplied by domestic manufacturers;

——Reach International Level

——Satisfy requirements of H.T. Industries

——Service lives of refractories have increased noticeably.

Strategic tasks in this period



- **The adaptation of “Reform and Opening up policy”.**
- **Introduction of Advanced Technologies and Equipment from Abroad**
- **Organization of State-Sponsored R&D Key Projects**
Sixth/Seventh/Eighth/Ninth Five-year R& D Key projects
- **Billions of investment in production line and plants**

1.3 Period of steady dev. (2011–present)

- Structural Optimization of Refra. Companies
Puyang Punai Co., Ruitai Keji Co., etc., Beijing LIRR, etc.
- Innovative Achievement in Science and Technology;
- **Automation and digitalization of production line.**

More efforts to

- **Efficient Utilization of Resources**
- **Environmental Protection + Energy Conservation**
- **Quality Consistency + Reliability**
- **Innovative Dev. in Science + Technology**

Present decade (2011-)

R&D Key projects

- Bauxite Based+ Magnesite Based Synthetics of Homogenized, Optimized + Converted Types
- Oxide-nonoxide Composite Products
 - Metal Incorporated In-situ Formed Non-oxide Bonded
 - Nitride/SiAlON Bonded Materials
- Energy Saving High Performance Castables
- High Strength Lightweight Materials

2. Achievements of HNRI

2.1 Main achievements of Sci.+ Tech.

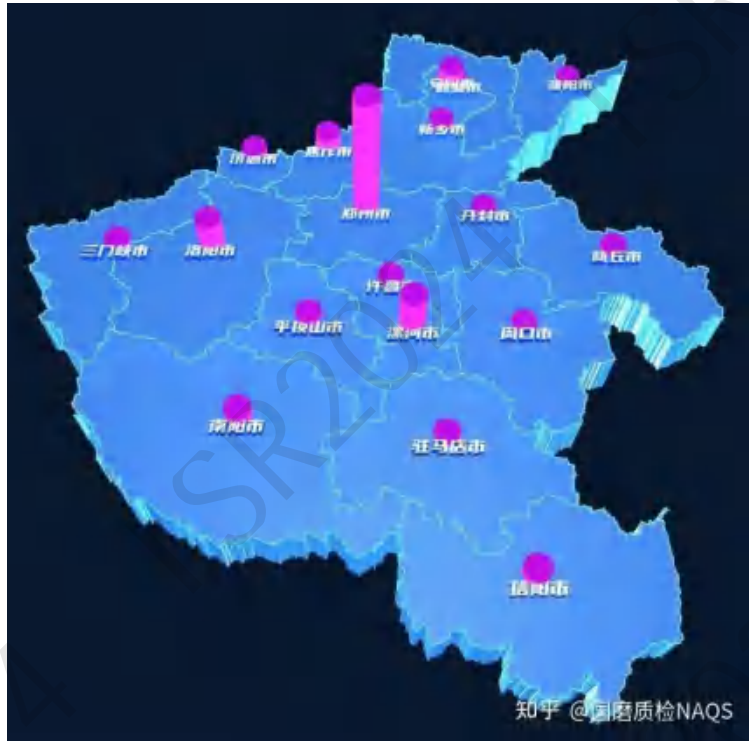
□ Mainly Depending on Innovative Technologies based on Our R&D

Achievements

- 60 provincial level R&D centers;**
- 230 high-tech enterprises;**
- 20 national Specialized “little giant firm”;**
- 24 national and provincial green factories;**
- 3,800 related patents.**

2.2 Structural adjustment + optimization

Refractory industrial clusters were formed in Zhengzhou (Xinmi, Gongyi), Luoyang, Sanmenxia, etc.



资料来源：前瞻产业研究院整理

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- The refractory industry of Henan Province ranks 1st in China;
- Zhengzhou City is the main refractory production area in Henan.

Xinmi Refractories Clusters

- **305 refractory enterprises;**
- **Annual production capacity of more than 9 mts, accounting for about 20% of the country and 40% of Henan Province;**
- **National Refractory Industry Base;**
- **Henan Refractory High-tech Characteristic Industrial Base;**
- **Henan Refractory Export Base;**
- **Xinmi refractory industry leads the development of refractories in Henan.**

Distribution of Henan main enterprises

- **>100m. RMB 111 enterprises**

1 enterprise with sales of more than 5 billion RMB,

2 enterprises with 2-5 billion RMB

12 enterprises with 0.5-2 billion RMB

96 enterprises with 100-500 million RMB.

The lion of enterprise in city as follows:

Zhengzhou: 61; Luoyang: 16; Nanyang: 11; Sanmenxia: 9

Puyang: 1, Other cities: 14

2.3 Automation and digitalization of HNRI

- Reorganization of Refra. Companies to Form Strong Production Forces
- Reconstruction of mining and manufacturing Plants With Adoption of Advanced Equipment



Automatic Warehousing

Adoption of Advanced Equipments

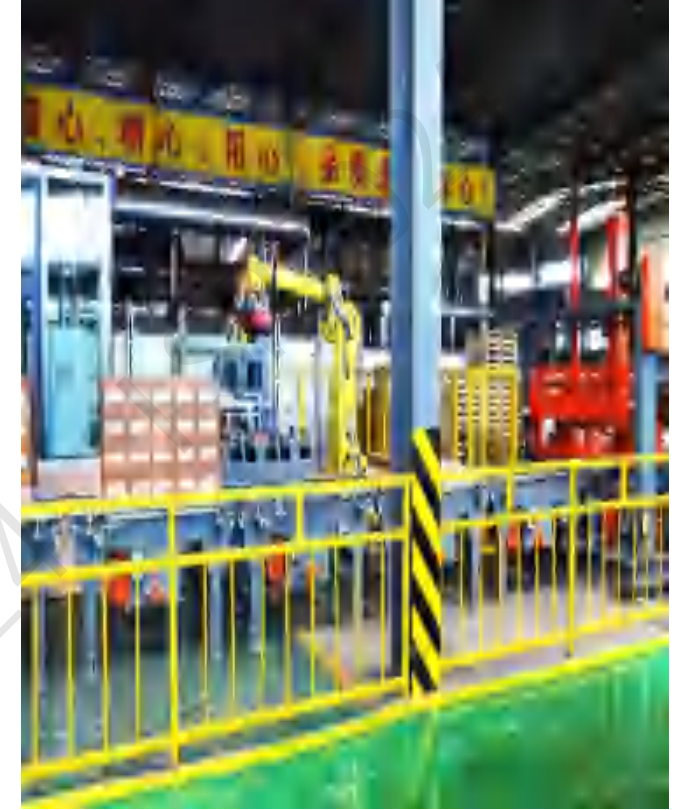
- **Automatic Batching lines for producing castables** were dominated in many enterprises in Henan.



Automatic Weighing and Mixing

Adoption of Advanced Equipment

- **Automatic packaging lines of castables and bricks.**



Automatic Packaging

Automatic molding lines



Automatic Production Line of Slide Plates

Adoption of Advanced Equipments

- **Automatic Batching lines for producing castables** were dominated in many enterprises in Henan.



Batching



Mixing machines



**Hydraulic press
equipped Robot**

Automatic, Intellectual energy-saving kilns



Tunnel kiln



Shuttle kiln



▶ Pusher kiln



Intelligent High Temp. Tunnel Kiln



DCS Control Center

2.4 Green development

◆ *Recycling resources*

◆ *Low carbon*

◆ *Energy saving*

◆ *Green factory*



◆ Emission Limit:

Particulate matter < **10mg/m³**,

SO₂ < **50mg/m³**

NO_x < **200mg/m³**

◆ The emission limit was much strict in Henan, which is 10mg/m³、30mg/m³、100mg/m³.

3. Some works of AHRI

- Standards and evaluation systems of refractory

- air pollutant emission;

- energy consumption limit;

- carbon emission limit

- green products



高温材料单位产品能源消耗限额

2023-01-03 发布 2023-01-03 实施

河南省耐火材料行业协会 发布



耐火材料单位产品碳排放限额

The limit of CO₂ emission per unit products of refractories

2024-01-26 发布 2024-01-26 实施

河南省耐火材料行业协会 发布



耐火材料工业大气污染物排放标准

2021-12-03 发布 2022-01-01 实施

河南省生态环境厅 发布
河南省市场监督管理局

- *To organize
the exchanges and mutual cooperations.*
- *To guide
the development of specialization, refinement, innovation.*
- To encourage the restructuring,
merger and reorganization of enterprises
- Hosted some summit forum and conferences
e.g. Green dev., Low carbon, Automatic and intelligent plant. etc.

Summit Forum on Green and Low Carbon Development of Refractory Materials

2024. 9. 3-5日, 耐火材料绿色低碳发展论坛



4. Problems of HNRI

- **Guarantee resources especially for bauxite are insufficient and limited;**
- **Industrial concentration of HNRI is low**
- **Technological innovation and equipment R & D level need to be improved;**
- **Collaborative R&D and innovation system have not been formed.**

Development Directions of HNRI

- High-end, intelligent, and green development direction;
- Low consumption, less emission, energy recycling and sustainability;
- To improve the modernization level of industrial chain and supply chain;
- To make stronger and Bigger

5. Summarizes

- ❑ **HNRI has a good industrial bases, the total production and the number of refractory enterprises rank 1st in China;**
- ❑ **high-end, intelligent, and green development direction**
- ❑ **low consumption, less emission, energy recycling and sustainability**
- ❑ **To establish long-term raw material suppliers and to maintain long-term relationship of mutual cooperation, to ensure the supply of raw material resources.**
- ❑ **Scientific and technological innovations, industrial coordination, green development are on the road.**
- ❑ **Make stronger and Bigger of HNRI**



Many thanks for your attention!