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# STACKING

ODDS MOVE IN FAVOUR OF KILN FURNITURE

**Jahir Ahmed** looks at how Asia's kiln furniture makers are gearing towards a more efficient, longer-term solution to the industry's requirements.

Asia's kiln furniture-using ceramic manufacturers are still principally in a situation of waiting for a wakeup call in determining trends and patterns of consumptions and procurements, as sources of established quality supplies are very limited and Asia's own kiln supplies, which have certain relationship with kiln furniture supports, are just emerging with Chinese historic trade expansion after decades of Japanese limited, but glorious, influence on the tableware manufacturing sectors.

Only in recent years the manufacturers of tablewares, sanitarywares, tiles and heavy clay products are trying to reshape the usage of traditional architectures of kiln furniture settings in firing their products in the kilns under their own recipes as they do changes in rawmaterial usage while producing finished ceramic products, for example, in pottery making, according to the industry sources. The Asian ceramic manufacturers have potentials in reshaping economy, firing quality and longevity of kiln furniture and firing kiln both, according to Tran Van Can, Director, Ceratec Centre for Science and Technology and Vice Secretary General, Vietnam Building Ceramic Association, based in Hanoi.

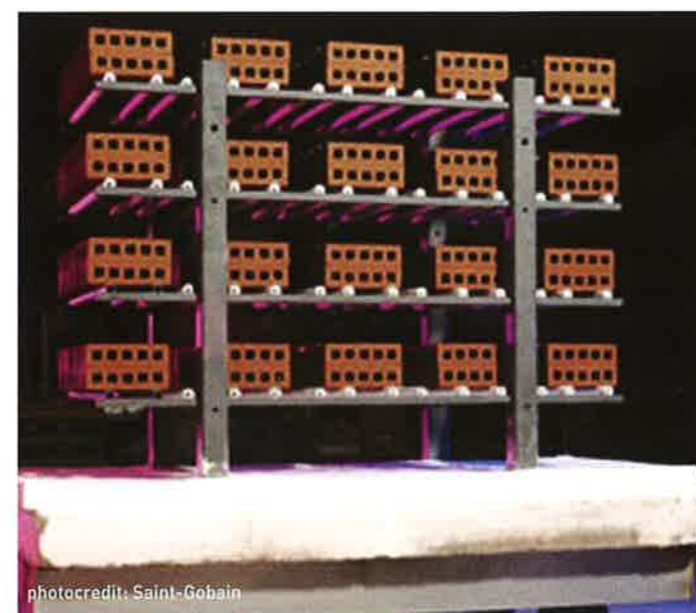
Using less kiln furniture, particularly in weight, size and less potential materials, helps in gaining more, in saving money, energy and time and improving quality of the fired products, is gradually changing the production environment and capital equipment

investment scenario in many ceramic factories, particularly in traditional ceramic sectors. Giving more attention to quality management in kiln operation and setting kiln furniture with less is paying higher dividend in many factories, resulting in forcing the monopoly suppliers introduce efficient, improved and innovative kiln furnitures, said the sources.

In kiln furniture manufacturing, supplies and catering the requirements of the Asian ceramic industries, a couple of global leaders dominate the market, although, in recent years, the Chinese kiln furniture operators have started grabbing the market shares from the global giants like Imerys and Saint-Gobain.

Under the Imerys Kiln Furniture (IKF) unit of Imerys Ceramic Materials division business group (Imerys Ceramics) of the France based company, Imerys, a significant part of Asian kiln furniture consumption and usage trend are influenced by kiln furnitures produced in Asia-based production unit of IKF in Thailand.

But the patterns of consumption are gradually changing with the arrival of kiln furnitures like commodities, for example, refractory bricks or clay bricks, with technical supports from the furniture makers, based mainly on cordierite and mullite. The ceramic manufacturers need to rethink about their firing management by shifting from less efficient kilns and less potential kiln furniture settings, according to Dr K.N. Maiti, Technical Advisor and Director of India's one of the leading sanitaryware manufacturers, Cera Sanitaryware Limited, based in Kadi (Gujarat) in India.



photocredit: Saint-Gobain

The ceramic industries that produce tablewares, sanitarywares, tiles, technical ceramics, etc, are provided with a full range of cordierite or silicon carbide based kiln furnitures, through IKF, which was integrated in 2014 with the Imerys Ceramics organization, the world's leading supplier of industrial mineral solutions, from minerals to full prepared bodies for the sanitaryware, tile and tableware industries, together with a competitive offering for engineering ceramics applications, according to the Paris-headquartered parent company, Imerys.

IKF develops, produces and markets products designed for the roof tile and ceramic industries. It includes individual firing supports, shaped parts designed to support the product during firing, and multi parts construction components for industrial kilns, refractory protections for kiln car walls and structures for the ceramic production.

Through its brand 'Imerys Kiln Furniture', the product range includes all types of tailor-made ceramic pieces in cordierite, high alumina porcelain, mullite and silicium carbide, and its Asia operations with various production units based in Thailand, serve the Asia Pacific region, in competition with its main rivals, another France based multinational company, Saint-Gobain, and several Chinese kiln furniture operators, including Beijing Trend and others, which are basically supplied with technology from UK, Germany, Japan and others.

With Saint-Gobain's significant global kiln furniture operation run from USA and strong South East Asia-East Asia supply base served from Thailand, both the France based non-metal conglomerations dominate the world and command the Asian kiln furniture and related other product markets and rawmaterial trade, because of ownership of mines, mineral processing and non-metal manufacturing throughout the world.

## More for less

A long-experienced top ranking ceramic industry executive, S B Zaman, is confident in gaining more for less in firing. Zaman, who was part of strategic commands at leading ceramic tableware industries in Bangladesh, including Shinepukur Ceramics Ltd, agreed on the high efficiency principle of "less is more," as he found reduction of weight of kiln furniture during firing increases productivity and reduces production cost.

"Less" refers to less in weight and thus also volume and thickness and does not refer to sacrificing indispensable kiln plates/shelves; if you can produce/fire additional products of the same weight of reduced kiln furniture," opined Zaman. "Because," he added, "kiln firing capacity depends on the weight of both your products to be fired and the kiln furniture."

The issue of economy in minimizing cost involvement in usage of kiln furniture, by reducing size, weight and amount of kiln furniture and saving space, energy and time, is ultimately making the total kiln operation cost-efficient. This will lead to help kiln ensure operation easier and profit-making as viewed by Can.

Can explored certain possibilities in letting the kiln become friendly to kiln furniture. "Less kiln furniture" helps find oven easy to use, and when the oven operation is easier, the oven is easier with furniture," suggests Can. He gave importance to make kiln furniture simple to operate for better benefit. "Follow me up," he urged the kiln furniture makers with a point raised to the need for more easy to use furniture and said, "make the design and manufacture of kiln furniture simple and easy to operate."

"The light weight kiln furniture usually relatively have better life in the kiln giving the kiln equally higher longevity and resulted economy in terms of output/unit cost," said Zaman. "Also use of less refractories is good for the environment of the factory," he added.

"Light-weight kiln furnitures increase the efficiency of the kiln through loading and unloading at ease, less energy usage, and reduced breakages; thus, less kiln furniture is beneficial for increased productivity, efficiency, profitability and good for sustainable environment," said Zaman, who is now a key executive at X Ceramics Limited, a leading tile manufacturer in Bangladesh..

Do all leading tile manufacturers in Asia study the impact of management of kiln furniture on their productivity? Companies were not sure they have real data of the firing to scrutinise usage of kiln furniture and restructure its usage for saving and quality production. Currently, FOB price of kiln furniture is on average about US\$1,500+ per ton, according to the types of the products.

Executives and operators connected with the management of three leading tile manufacturers in three South East Asian countries indicate Asian Ceramics of a certain gap in communications between the management and the personnel responsible with the task of efficient usage of kiln furniture. The company management and plant engineers/production managers need to bridge the gap to ensure better operation. Industry sources believe that many factory inventories are less scrutinised and overstuffed with less potential kiln furnitures.

Knowledgeable sanitaryware manufacturers are more concerned like those of tableware makers. Dr Maiti, who is a reputed Indian ceramic scientist and expert in ceramic manufacturing, opposed the absence of strategic loading of the kiln furniture for firing at sanitaryware manufacturing plant.

Dr Maiti believes the ceramic producers who manage firing can offer better quality production and ensure quality-fired products for less, by efficient usage of kiln furniture and resulted safer and quality operation of kilns. "Minimize parasitic loads of kiln

# Analysis: Kiln furniture

furniture,” Dr Maiti suggested strongly. For quality manufacturing, he favoured maximizing return by less usage of kiln furniture in technical and economic term. In his recently published, latest authored book, “A HANDBOOK FOR PRODUCTION OF VITREOUS CHINA SANITARY WARES,” he suggested use of low thermal mass kiln cars to improve efficiency.

“Use low thermal mass kiln cars to improve overall efficiency in using kiln furniture like cordierite, mullite, sillimanite and recrystallised silicon carbide,” said Dr Maiti, formerly, a Director Grade Scientist and Scientist-in-Charge of India’s central government run Central Glass and Ceramic Research Institute (CGCRI).

## Efficiency upturns

The Chinese kiln furniture manufacturers are now spending more on R&D and the government is desperately supporting them to be competitive with the Western rivals by increasing efficiency. Despite presence of Imerys and Saint-Gobain in China, the world’s largest domestic market, the Chinese companies are selling at home and to the Asian countries as best alternative, against the reputed Western brands. The local materials are reportedly equally attractive and better economic to the domestic users who manufacture ceramic products for export shipments. Local brand Beijing Trend, in technical collaboration with some UK brands, is now most competitive.

Industry sources said the Chinese users of kiln furnitures are more serious for improving economic efficiency in firing and the kiln furniture makers are getting supports from the government to improve their products. In 2014, the Fujian provincial government recognized the kiln furniture manufacturer, Fujian Dehua Chuang Jie Kiln Furniture Co Ltd (Chuang Jie), as provincial high tech enterprise, as part of the Chinese government’s encouraging the ceramic manufacturers to be more efficient in energy usage, environment-friendly and economic in production.

Chuang Jie, based in Dehua of Fujian province, has in recent years earned high reputation for its market-demand oriented innovative kiln furnitures, by combining mainly cordierite and mullite. Chuang Jie’s cordierite-mullite kiln furniture is a combination of cordierite, mullite, clay materials and a small amount of additives, through batching, mixing, shaping, drying and then sintering at high temperature with a series of physical and chemical reaction, which form a hard substance.

Composed of 40-55 percent cordierite, 30-50 percent mullite and 10-15 percent glass phase, it takes full advantage of the low expansion of cordierite and high temperature resistance of mullite, to make ideal kiln furniture for firing where operating temperature is under 1350 degree centigrade.

For tablewares, Chuang Jie has developed ultra thin butts used with SiC support together. It increases loading capacity, reduce energy consumption, save cost and improve product quality, claims Chuang Jie. The manufacturer was able to extend the service life of extruded butts for sanitarwares, by improving production process, especially, SiSiC beams of RSiC beams as the support, eliminating deforming and cracking in long term use. Its perforated extruded butts are with two-side misplacement hole to ensure enough air circulation and avoid contamination in production process, to improve quality of sanitarywares.

However, Imerys still has its cutting edge over others, according to IKF.

Among the Chinese kiln manufacturers who have competitive edge in quality and prices in competition with the traditional market leaders, Beijing Trend Industrial Ceramics Co Ltd, based in Huoxian Town of Tongzhou District in Beijing, has in recent years developed

photocredit: Imerys



### Imerys Kiln Furniture (Thailand) Co Limited (IKF)

**Location:** Ta Luang, Saraburi, Thailand  
Imerys Ceramics Asia-Pacific/Imerys Ceramics China location: Shanghai, China

**Products:** Ceramic kiln furniture for all types of ceramic manufacturing

**Markets:** Domestic and export markets

**Others:** Imerys Kiln Furniture (Thailand) is a leading global supplier of kiln furniture and technical ceramics and Asia-based kiln furniture operation of global leader Imerys of France. It produces both cordierite and silicon carbide in addition to mullite, alumina and zirconia. Its Thailand base is Asia continental operation with headquarters in Bangkok. The Thailand base has one of Imerys major R&D facilities.

### Saint-Gobain

#### South East Asia operation HQ

**Location:** Thanonphayathai, Ratchathewi, Bangkok 10400, Thailand  
Asia-Pacific operation HQ location: Shanghai 200001, China

**Products:** Kiln furniture and other ceramic materials

**Markets:** South East Asian and East Asian countries

**Others:** Saint-Gobain’s Asia-Pacific and South East Asia operations are part of Saint-Gobain Ceramic Materials, based in Worcester (MA), USA, which developed kiln furnitures for marketing worldwide.

### Beijing Trend Industrial Ceramics Co Ltd

**Location:** Matou, Huoxian Town, Tongzhou District, Beijing 101109, China

**Products:** Ceramic kiln furniture for manufacturers of traditional ceramics and others

**Annual production capacity:** 11,000 tonnes of cordierite-mullite products

**Markets:** Domestic and export markets. The products are exported globally

**Others:** Beijing Trend Industrial Ceramics is China’s leading and best known kiln furniture manufacturer. It has global partnership with IPS Ceramics/Dyson Thermal Technologies (UK) and EmcoTherm (Germany). It produces kiln furniture and refractory materials for traditional and industrial ceramics and others.

### Jiaozuo Beixing Refractory Co Ltd (BRCC)

#### (Silicon carbide (SiC) products factory)

**Location:** Baishan industrial zone, Jiaozuo City, Henan Province

**Products:** Kiln furniture and other refractory products

**Annual production capacity:** 20,000 tons of SiC products, which included nitride bonded silicon carbide ceramic plate, oxide bonded silicon carbide, reaction bonded SiC kiln series, mullite ceramic sagger, silicon carbide brick, etc.

**Markets:** Domestic and export markets.

**Others:** BRCC’s export markets include Japan, Thailand, Malaysia and Vietnam, where shelf board, brace, beam and sagger have good demand. It also other refractories.

high quality products and attracted buyers from Asian countries. Its global partnership with IPS Ceramics/Dyson Thermal Technologies (UK) and EmcoTherm (Germany) has provided good advantage to develop its products in collaboration with the European partners to enhance customers' confidence in the markets.

The products are competitive in the domestic and export markets both in terms of quality and prices. Its extruded butts with holes have high standard of flatness and dimensional accuracy. The company claims its extruded butts are now amongst the leading products in Asia, as well as in the domestic market.

Beijing Trend's ceramic kiln furnitures are used in almost all sectors of traditional ceramics from potter to heavy clay, but it is mainly applied in the sanitarware manufacturing. The butts' weight reduction of 35-50 percent. Its expansion of load capacity is also attractive. The company claims its 33mm thick extruded butt has the same weight as a 23mm thick pressed butt of the same size and it can bear five time the load.

To offer the better flexibility of choosing complex secondary kiln furniture, particularly to the tableware manufacturers, Beijing Trend is expanding its ranges of solutions.

## Support and development

The ceramic kiln furniture manufacturers in China are now involving their customer ceramic manufacturers in learning how to improve usage of kiln furniture. The kiln furniture makers are advising their customers to use kiln furniture efficiently. Jiangsu Yixing Zhongcun Kiln Products Co Ltd (Yixing Zhongcun), based in Yixing in Jiangsu province, always advise the users of their kiln furniture to be efficient in usage of those materials by improving quality in firing and saving energy and money, which is equally supportive to the phase of "less is more."

Through the burning of 1400°C, its products can offer mild, bright and white enamel feeling, claims Yixing Zhongcun. It says, its kiln furniture can save energy and increase the volume of kiln, efficiency in burning and to be economic. It advises careful loading, not to pile the SiC refractory materials on the top of another, and suggests to put the kiln furniture in a vertical order. When building refractory plates, the refractory supporters should be aligned. The distance between refractory plates should keep upon 15-20mm, the manufacturer advises the customers.

Some of the Chinese kiln furniture manufacturers have their own ceramic manufacturing plants that use their own products and help the customers get a technical demonstration before buying decisions. Tangshan-based Tangshan Imperial-Hero Ceramics Co Ltd (Imperial-Hero) produces high-grade kiln furnitures. It has its own high grade bone china manufacturing unit with an annual production capacity of 8 million pieces, which includes, among others, hotel wares, dinnerwares and gift/art items. The demonstration makes it highly competitive. The customers can also learn economic use of the kiln furniture.

Imperial-Hero manufactures mullite-cordierite kiln furniture, developed in co-operation with Dyson Industries Limited of UK, which is a globally reputed kiln furniture manufacturer. All of the raw material is imported from Western Europe and the quality of productions is of the international standard, the company claimed. The kiln furniture is mainly applied in the manufacture of porcelain and bone china tablewares and kitchenwares, sanitarywares, tiles, crystalline glass, magnetism materials, etc.

Many of the Chinese kiln manufacturers now produce high temperature tolerant materials, particularly, for technical ceramics. Yixing-based Jiangsu Sanheng High-tech Kiln

### Fujian Dehua Chuang Jie Kiln Furniture Co Ltd

**Location:** Dehua county, Fujian province, China

**Products:** Cordierite-mullite kiln furniture for tablewares, sanitarwares, tiles, etc.

**Annual production capacity:** 5,000 tons of kiln furnitures

**Markets:** Domestic and export markets

**Others:** In 2014, the Fujian provincial government recognized the manufacturer as provincial high tech enterprise.

### Tangshan Imperial-Hero Ceramics Co Ltd

**Location:** Lubei District Tangshan City, China

**Products:** Mullite-cordierite kiln furnitures and silicon refractory materials

**Annual production capacity:** 5,000 tons of mullite-cordierite kiln furnitures

**Markets:** Domestic and export markets

**Others:** Tangshan Imperial-Hero Ceramics is a joint-venture investment with Tangshan Baiyu Ceramic Co Ltd and Futian-Sanjin Trade & Industry Company.

### Jiangsu Yixing Zhongcun Kiln Products Co Ltd

**Location:** Yang'an Country, Dapu Town, Yixing City Wuxi, Jiangsu 214226, China

**Products:** Kiln furniture for tablewares and sanitarywares.

**Annual production capacity:** About 800,000 pieces of boards or over 5,000 tons

**Markets:** Domestic and export markets

**Others:** Jiangsu Yixing Zhongcun Kiln Products Co is a joint-venture foreign investment. It is specialist on refractor boards of carborundum

### Jiangsu Sanheng High-tech Kiln Furniture Co Ltd

**Location:** Yixing Ceramic Industrial Park, Yixing, China

**Products:** High temperature tolerant kiln furnitures for specially electronic ceramics

**Markets:** Domestic and export markets

**Others:** Sanheng's main product, the sandwich plate, is a three-ply composite structure plate.

### Refmat Corporation

**Location:** Luoyang, Henan, China

**Products:** High temperature tolerant ceramic kiln furniture

**Markets:** Domestic and export markets

**Others:** Refmat's kiln furnitures are mainly of SiC, such as, ceramic tube, corundum, high-alumina, mullite, and SiSiC beam, etc, for the manufacturers of technical porcelain products, including, electrical insulators.



photocredit: Jiaozuo Beixing Refractory

Furniture Co Ltd produces high temperature tolerant kiln furnitures applied specially in producing various kinds of electronic materials (components), and special ceramics.

The manufacturer claims to be the largest manufacturer and supplier of sandwich plates and push plates in the world. It provides kiln furniture and furnace lining for all kinds of electronic materials including electronic components, phosphor, lithium battery anode, cathode materials, and special ceramics. Sanheng's main product, the sandwich plate, is a three-ply composite structure plate.

Due to diverse range of products, some of which are fired with high temperatures, the customers of kiln furniture also want materials of higher tolerance. The market of high temperature tolerant kiln furniture is expanding in China and the world markets for wider demands of porcelain products, which are fired with higher ranges of temperatures, above the normal high of 1300-1400°C, according to the company sources.

## Lighter and brighter

The ceramic manufacturers said they look for lighter kiln furnitures for efficient usage. "Lighter materials help in better and faster handling and saving energy," said Bangladesh's Zaman. The availability of lighter kiln furniture at cheaper price with equivalent quality in China has diverted many customers from going to Thailand. Imerys IKF's Thailand based Asian manufacturing is now giving emphasis on such views of the customers to remain competitive. Many of the Bangladeshi and Indian customers buy from Thailand, like those of other South and South East Asians, even East Asians and Australians. One of IKF's Asian rivals, also Thailand-based, Patra Refractory Company Limited supplies light weight kiln furnitures to the region's many factories.

Located at Nongkhae Saraburi, it produces annually 30,000 tons of various kiln furniture and refractory products, including setters, supports, monolithics and refractory bricks. Those are, especially, of light weight, easy to handle and energy saving. The products have demand in many Asian countries from Japan and Australia to the Middle East and Europe, where the customers use the materials in shuttle and tunnel kiln firing for manufacturing tablewares, tiles, sanitarywares, gift and decorative items, figurines and other kinds of ceramic art pieces. According to Patra's Deputy Managing Director Phadet Darote, some 70 percent of its production is consumed domestically.

Imerys, with its IKF (Imerys Kiln Furniture Thailand Co Limited) continues to remain market leaders for its high performance kiln furniture made of quality raw materials and for combining modern technologies, including spray drying, dry pressing and high accuracy in high temperature firing of biscuit, glost, and decoration, enabling tablewares of different types, porcelain, bone china, stone ware, earthenware, etc, have customized solutions. Imerys' other important advantages is of its use of cordierite and silicon carbide in addition to mullite, alumina and zirconia. Its R&D in Thailand also provides an unbeatable advantage.

Saint-Gobain High Performance Refractories kiln furniture for building ceramics of all types, specially, of floor, wall and roof tiles, provides delivery of advanced SiC rolls for roller hearth kilns and complete kiln car construction for both shuttle kilns and tunnel kilns.

It delivers complete kiln car construction comprising its LO-MASS superstructures made of premium SiC products, siliconized



Silit SK, recrystallized Crystar 2000 and nitride bonded Advancer. Its LO-MASS concept, includes beams, stringers, batts, various supports, multi-lug posts, lav rings, bowl and tank setters, said the company. The multi-lug posts system designed to fit into the kiln car base allows flexibility in shelf height for easy firing of all items on the same car.

The LO-MASS kiln furniture system reduces fuel and grinding costs, ware rejection, and maximizes use of kiln volume. The high strength, low mass and thermal properties of bowl and tank setters, make them a superior choice over cordierite setters. They retain their shape over their extended service life resulting in flatter post-fired items, said Saint-Gobain. It also claims the high thermal conductivity of the SiC based setters reduces bowl and tank stress cracks that occur during firing and cooling.

Saint-Gobain said its LO-MASS offers a lots of benefits, including, automation flexibility, lower firing costs, better product quality, longer service life, faster firing cycles, and more setting flexibility.

### Patra Refractory Company Limited

**Location:** Kokeyae, Nongkhae Saraburi 18230, Thailand

**Products:** Various kiln furnitures and refractory bricks of light weight  
**Annual production capacity:** 30,000 tons of kiln furnitures and refractor bricks

**Markets:** Domestic and export markets

**Others:** Patra's kiln furniture products include setters, supports and monolithics and are shipped to export markets worldwide.

### Carborundum Universal Limited (CUMI)

**(CUMI ceramic division's super refractories department)**

**Location:** (1) Gandhi Nagar, Adyar, Chennai, Tamil Nadu, India  
(2) Mungileri Village, Vinnampalli Post, Katpadi Taluk, Vellore, Tamil Nadu, India

**Products:** Ceramic kiln furniture and refractor products

**Markets:** Domestic and export markets

**Others:** Product lines in the fired range include silicon carbide, nitride bonded silicon carbide, mullite, and zircon mullite, high alumina, and insulating fire bricks.

### Abref Private Limited

**Location:** Sipcot Complex, Gummidipundi, Chennai, Tamil Nadu, India

**Products:** Cordierite kiln furniture for traditional ceramics

**Markets:** Domestic and export markets

### Anmol Ceramics

**Location:** Navagram Village, Thangadh, Gujarat, India

**Products:** Ceramic kiln furniture for tablewares, sanitarwares, tiles, heavy clay items, etc.

**Market:** Domestic and export markets

### Khyati Ceramics

**Location:** 179-180A, GIDC, Kaalol, Gujarat, India

**Products:** Cordierite kiln furniture for traditional ceramics

**Markets:** Domestic and export markets

### PT BIOTA Indonesia

(Foreign kiln furniture makers' representative for customized supplies)

**Location:** Kebon Jeruk, Jakarta Barat 11530, Indonesia

**Products:** Kiln furnitures, including batt, support, beam, crank, setter, saggar, etc

**Sourcing markets:** All

**Others:** Biota represents various reputable principals from several countries for raw materials, kilns, and kiln furnitures.