



PROJECT **CHANGSHU**

Startup of new Organic Peroxides production plant
in Changshu (*China*)

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15 **KEY PROJECTS FOR ARKEMA**

“A new plant boosting Arkema’s ranking as the world’s n°2 Organic Peroxides producer.”

Why ?

Why build a new Organic Peroxides plant in China?

The decision to build a new plant in China falls in line with Arkema’s expansion strategy including the creation of new facilities in Asia. For the Organic Peroxides Business Unit, this means the logical consolidation of existing operations. The BU already achieves 12% of its sales in Asia (17% including non-consolidated partners) through its own facilities as well as joint ventures:

- **In Japan**, with Arkema Yoshitomi (company set up in 1961, 49% Arkema)
- **In Korea**, where Arkema owns 51% of the joint venture established with Seki in 1998
- **In India**, with Arkema Peroxides India, 100% Arkema since 2002.

The new Changshu plant therefore complements and consolidates a long-standing presence.

What about the challenges for Arkema? And the prospects?

Arkema is the world’s second largest producer of Organic Peroxides, and now operates 11 production plants in the world, in Asia (China, Korea, India, Japan), in America (two plants in the United States - Texas and New York State -, one in Brazil and one in Mexico), and in Europe (Germany, France, Italy). Asia is a buoyant region where the annual growth rate for organic peroxides ranges from 5 to 7%.

Used primarily as polymerization initiators for polyethylene, polystyrene, PVC and acrylic resins, Organic Peroxides are by definition unstable products. Local production unables to reduce transportation that demands very low temperatures. With a 3000 tpa capacity, the new plant, operating on our Changshu

industrial platform (Shanghai region), reinforces Arkema’s presence in a region where demand for Organic Peroxides is growing significantly in parallel with polymer growth.

What are the applications of Organic Peroxides?

Organic Peroxides are fine chemical intermediates. They are marketed by Arkema under the trademark Luperox®, and have three main application areas:

■ Polymerization

Luperox® initiators are used for the radical polymerization in the production of commodity polymers such as polystyrene and styrenic copolymers (SAN, ABS, SBR, etc.), PVC, low density polyethylene, and acrylics. They act directly on the monomer as polymerization takes place. Some Luperox® grades are also used to modify the rheology (elasticity, etc.) of polypropylene to make it more fluid and hence easier to convert.

■ Crosslinking

In the field of crosslinking, Luperox® acts on the polymer itself rather than on the initial monomer. Its function is to “link up” together the polymer chains, which helps improve the polymer’s mechanical properties and heat stability. The main application markets in this sector include cable manufacture, industrial rubber for automobile applications, construction, and footwear manufacture.

■ The curing or hardening of unsaturated polyester resins (UPR)

The Luperox® range for the cold or hot curing of unsaturated polyester resins mainly comprises ketone peroxides, peresters, paracetals, and benzoyl peroxides. In this industry, Luperox® is used in particular in the construction, transportation and leisure sectors.



Romuald de Haut de Sigy General Manager Europe/Asia within the Organic Peroxides BU

To carry through a project of this kind requires the pooling of a number of resources, i.e. financial, technological, administrative, commercial, marketing, etc., but this project above all has required significant human input.

The project entailed three consecutive phases involving a variety of players from the Business Unit:

- a commitment / decision phase
- a technology and construction phase
- a startup phase

Commitment / Decision / Organization

Overseen by Romuald de Haut de Sigy, General Manager Europe/Asia within the Organic Peroxides BU, this phase was intended to draw up the project's various economic and strategic aspects, and to identify the challenges for the Company. This preparatory phase helped determine the human organization and the various resources required. A steering committee comprising the BU's senior management was set up, and decided on any modifications, as required. ■ ■ ■

How does the Organic Peroxides market lie?

In Western countries, the market is growing at approximately the same rate as the gross domestic product, i.e. an average of 2 to 4% per year.

In Asia, the Organic Peroxides market is mixed, with two different patterns:

- **The first**, prevailing in Korea and Japan, revolves around technology and service. These are mature, insular markets in which commercial development requires an industrial presence. Arkema operates in this market through two joint ventures, Yoshitomi in Japan and Seki in Korea.
- **The second** typifies high-growth countries, as China and South-East Asian countries, that offer the highest investment potential in polymers. In particular, growth in China has attracted a large number of local players, as well as the major polymer players like BP, BASF, Formosa, Total Petrochemicals, and regional players including from Japan and Korea. In order to maintain its ranking among the 3 leaders, Arkema had to follow this growth by investing in China.

Customer service, reactivity to respond, and a refrigerated logistics set-up all combine to rank Arkema in a leading position in the Organic Peroxides market for polymer initiation throughout the region of China, Taiwan and South-East Asia. ■

How?

A highly successful startup

The Changshu Organic Peroxides plant came successfully on stream in the Spring of 2005, on schedule, and within both the production specification and the budget.

The project owes its success to the combination of three key factors:

- The benefits that Changshu was able to draw on from technological progress at other Organic Peroxides plants, in terms of both productivity, through the constant improvement of manufacturing processes, and plant safety.

The new plant benefits from the technical expertise and innovation drive of the German and Indian plants, and of the US Crosby plant (Texas) for the entire downstream part.

- Close cooperation and the transfer of skills between teams, in particular those from the "sister" plants in Günzburg, Germany, and Cuddalore, India.

- The advantage of being able to capitalize on existing infrastructures.

Finally, it should be noted that no technical incident and no injury were recorded, not just during the construction phase, but especially during the startup, a real "danger zone" for products like Organic Peroxides.



▲ A few key dates

April 2003

Approval of project by Executive Committee

November 2003

December 2004

Construction of the plant

Spring 2005

Startup of production

October 25 2005

Inauguration of new plant in the presence of the Chinese authorities and Thierry Le Hénaff

■ ■ ■ Technology and Construction

A technology and construction team was created, and included 4 people responsible for overseeing the project's various phases over two years:

■ 2 people permanently in situ:

G. Jeyaraj, an engineer from India, and Pascal Leroy, Project Manager and Commercial Manager for the Organic Peroxides BU in Asia.

■ 2 Technical Managers in charge of supervising the project for all process issues:

S. Krishnan, Industrial Manager Organic Peroxides for Asia, and Philippe Maj, European Process Technology Manager who put their experience in Organic Peroxides at the service of the project, guided the technological choices, and managed the plant's startup phase.

The procurement of external services was taken care of by Arkema China Engineering.

Startup

The startup phase again involved the technology and construction team, as well as the startup team, placed under the responsibility of S. Krishnan, and coordinated by Jack Hu, now Manager of the Organic Peroxides plant. With the help of HR at the Changshu facility, we recruited and trained 45 people for the startup and operation of the plant. Once again, personnel from the "sister" plants in Cuddalore (India) and Günzburg (Germany) were heavily involved, taking turns on the site over several months to train the Chinese team and ensure the transfer of skills.

Glossary

Initiator

A substance that, used in small amounts, initiates a chemical reaction. The most common initiators are Organic Peroxides.

Luperox®

Trademark under which Arkema markets its Organic Peroxides.

Polymerization

A chemical reaction transforming one or more monomers or a blend of monomers and oligomers into polymers.

Crosslinking

The crosslinking of a polymer material is a chemical reaction taking place during polymerization, polycondensation or polyaddition, which permanently links up together the macromolecules that make it up.

During crosslinking, the state of the polymer changes from a paste or a viscoelastic solid to a rigid, elastic and infusible solid.

Rheology

A branch of mechanics that studies the behavior of materials in relation to stress and deformation.

▲ A few figures

440,000
man-hours

No recorded
accident

Plant built over an area
of **3,8 hectares**