

Fire More for Less!

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Ceramic production is a complex process involving various elaborated and costly steps. Firing is one of the most important steps, in terms of results, as clay body transforms into ceramic but also in terms of cost, as the process requires a lot of energy. The energy used during the firing process is needed to allow transformation of the clay pieces into ceramic as well as to heat up the kiln furniture holding the pieces in the kiln. Therefore the energy used for the kiln furniture does not bring any added-value to the process: it is known as an unavoidable cost. As a kiln furniture supplier, Imerys Ceramics/FR used these facts as a starting point for its development work and set itself as a goal to contribute to energy saving during firing through new kiln furniture design and/or compositions.

How to reduce the firing cost of the produced pieces?

Reducing firing cost can be achieved through weight reduction of the kiln furniture. Indeed any kilogram pushed in the kiln needs energy to be heated but also to be cooled down. Therefore, one of the solutions is to reduce the volume of the kiln furniture by improving its design.

How can the design be maximized in order to reduce it to the minimum? This has been performed by the kiln furniture developed by Imerys Ceramics in many occasions. One of the most successful achievements was the launch of the O-setter for the firing of hard porcelain or stoneware plates.

This process resulted in saving up to 46 % on the larger sizes of plates without affecting, in any way, the performance of the setters. In addition to this massive weight gain, Imerys Ceramics managed to offer a more compact staking of the plates, this benefit offering 12 % extra production capacities. This result does not require any change on the kiln itself, no investment nor any modification.

Even with extra pieces in the kiln, the total weight passing through the kiln i.e. products and supports, remains inferior to the one passing with the traditional firing supports.

Another Imerys Ceramics solution to reduce firing cost is the weight reduction of the body itself. Lower density appeared quickly to Imerys Ceramics as a development axis. Indeed energy consumption during firing is

Tab. 1 Benefits brought to Imerys Ceramics customers using GreenLite® and design optimisation

Before GreenLite®	With GreenLite®	Overall Results
16 cassettes per pile	17 cassettes per pile	+1 cassette per pile
1024 cassettes per kiln car	1088 cassettes per kiln car	+64 cassettes
5796 kg kiln furniture per kiln car	5355 kg kiln furniture per kiln car	-441 kg
4608 kg roofing tiles weight	4896 kg roofing tiles weight	+288 kg
Valuable weight: 44,3 %	Valuable weight: 47,7 %	+8 %
Total weight: 10 404 kg	Total weight: 10 251 kg	-123 kg

proportional to the weight entering into the kiln. The weight is the sum of by two components: the customer's products, which cannot be changed and the kiln furniture itself, which can be improved by using low density bodies.

In this second case, the challenge of Imerys Ceramics was to reduce the density without affecting the other parameters of the body. Through research, Imerys Ceramics successfully launched GreenLite® which has now become a standard of Imerys Ceramics kiln furniture, being supplied for more than 5 years. The results of this new light H-cassette design are significant:

- 20 % less kiln furniture weight per roofing tile weight ratio
- 8 % less gas consumption (measured)
- CO₂ quota saving, proportionally with the energy saving.

Once again, the implementation of GreenLite® requires no technological change for the customer. Tab. 1 gives additional information on the benefits of the GreenLite® used in firing roofing tiles.

As mentioned before, Imerys Ceramics offers two solutions to reduce the firing cost of produced pieces by reducing the volume of the kiln furniture via improving its design and by reducing the weight of the body itself.

Another option is the optimisation of the loading per kiln car, through an optimised tower plate. Imerys Ceramics succeeded in optimising the loading per kiln car in the tableware industry creating a new tower plate.

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Fig. 1 Kiln car before using GreenLite® ...



Fig. 2 ... and with GreenLite®

The construction of Imerys Ceramics' tower plate is based on shape optimisation using various materials (associated use of SiC and mullite) and an innovative fixing system allowing rotation of each plate setter. This achievement has been possible thanks to Imerys Ceramics' experienced design team and close cooperation with their customers. The Imerys Ceramics' in-house simulation tool, developed over the last decades, allows the simulation of the thermal and mechanical constraints the piece to

be fired has to face during the firing process while optimising the pieces design ensuring that a safety factor is always considered. Imerys Ceramics set its goal on contributing to energy saving during firing. Thanks to its expertise, material development and innovative designs, the company succeeded and launched new standards:

- GreenLite®, based on a material which is 20 % less dense than the standards
- new O-setters and tower plate designs allowing to increase firing density.

Imerys Ceramics' innovative kiln furniture developments offer to its clients multiple benefits. Customers have experienced obvious gains on energy consumption regarding the kiln as well as the firing capacity, considering the volume reduction of the kiln

furniture. In some cases, faster firing cycles have also been achieved as the reduction of the total weight passing the kiln allows shortening the firing cycle.

To a lesser extent, a gain on maintenance is the result of the global kiln car weight reduction as it decreases the efforts on all the moving parts and the pushing system of the kiln itself.

As regards to the tower plate, the existing equipment parts have a higher rate of utilization.

As a leader in ceramic solutions, Imerys Ceramics provides tailored innovation and technical support services based on a global network of R&D centers and regional laboratories, allowing worldwide development partnerships.

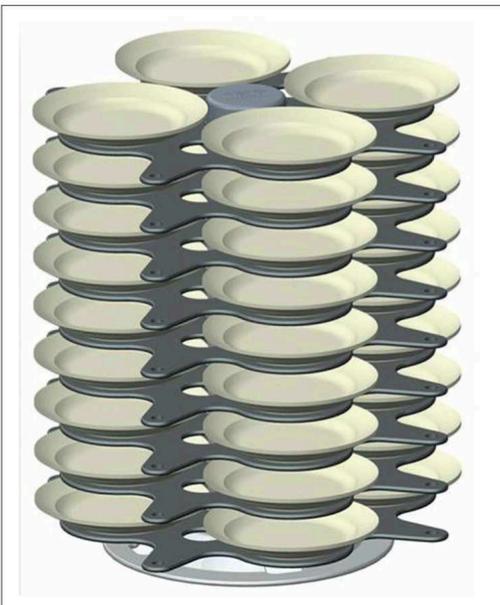


Fig. 3 3D-design of the new tower plate



Fig. 4 Imerys Ceramics' tower plate

(Figs.: Imerys Ceramics)