Revamping Industrial Kilns for Manufacturing Ceramic Sanitaryware

J. Ridder

Industrial kilns for manufacturing ceramic sanitaryware demand high investment, but also remain stable in value as production equipment. Therefore, and to meet requirements for increasing efficiency, focus is shifting onto the revamping of already installed kilns.

1 Reasons for revamping kilns
Revamping means making something better or restoring an "as new" condition, the reasons for revamping being very diverse. Revamping is:

- In some cases, a cost-efficient alternative to a new kiln
- Necessary when the quality of the fired products deteriorates because of the kiln, such as, for example, product contamination or cracks in the visible and functional areas of the sanitaryware article
- The maintenance costs of the kiln regularly exceed the planned budget and are steadily increasing
- Sensible when the kiln is structurally sound, the functionality is essentially stable and the kiln itself is not technically too outdated
- Necessary when replacement parts are discontinued
- Recommended when the kiln is to be moved
- Especially necessary owing to meet obligations resulting from environmental protection/energy consumption and plant safety
- A strong element in improving efficiency
- Integral to funding measures.

2 Various concepts for revamping
All three types of kiln used mainly in the production of sanitaryware can be modernized, that is tunnel kilns, roller kilns and shuttle kilns. Primarily, it is certainly the most interesting measure to modernize continuously operated kilns. On the market, it has become established practice in recent years to modernize the following kiln components:

2.1 Kiln lining
Up to around 15 years ago, full-fibre linings were common worldwide. Once state of the art, the full-fibre lining has now largely disappeared, and that is for reasons of work safety and especially on account of the sometimes detrimental properties of the fibres, e.g. the aging process, which leads to a change in the insulation capacity. These full-fibre linings can be replaced today with more modern insulation materials, e.g. lightweight refractory bricks or cordierite boards. The materials used today are not only safe with regard to work and environment protection and change their properties only insignificantly over a long period, they even lead to energy savings on account of an improved insulation capacity.

2.2 Kiln equipment
In the production of sanitaryware, the kiln equipment, e.g. fans, measurement, control and actuating elements can be replaced with modern, low-noise and more efficient components. Furthermore, the possibility...
2.4 Electrical measurement and control equipment in the control cabinet with combination with Industry 4.0

Modern measurement and control systems today are based almost exclusively on PLC solutions with add-on visualization products, e.g. Siemens Simatic S7 with the visualization tool WinCC. These modern control systems maximize measurement and control accuracy and at the same time offer an easy-to-use and precise visualization for operation of the kiln and for product/batch tracking.

Continuing on from that, today add-on functions are increasingly necessary, like, for example, management of the car setting so that ongoing information can be provided on which product is at which position in the production process and therefore in kiln operation.

These data connections are incorporated so far in kiln operation that, for example, car overloading or car underloading is indicated by a kiln alarm, to enable immediate re-adjustment of the car setting in the short term in order to guarantee consistent kiln operation with maximized energy and emission efficiency.

2.5 Heat recovery and emission reduction

This aspect is certainly the most interesting at present, but also the most demanding item in the “revamping” package. In the case of heat recovery, the goal for the future is not only to recover the enthalpy of the total kiln waste air, but also to recirculate kiln heat losses from other sources, such as radiation losses of the kiln body, to the kiln or other consumers in the production process in the form of usable energy.

The available elements of heat recovery comprise besides the traditional air/air or air/water heat exchangers also forward-looking systems, e.g. ORC systems. The most common goal in sanitaryware manufacture is to supply the recovered energy to the kiln as especially in countries with warm climates not all waste heat from the kiln is needed in the process.

The topic of emission reduction is coupled with energy saving. If less energy is consumed, the emission of climate-harmful flue gas components is reduced. In addition, there are increasing demands worldwide...
to eliminate the emission of e.g. hydrofluorides almost completely by means of suitable dry or wet filters.

3 Outlook
Revamping kilns for the manufacture of ceramic sanitaryware presents a real alternative to new kilns as, with well-considered and selective investments, relatively large improvements can be achieved in product quality and kiln efficiency. To meet the requirements associated with Industry 4.0, highly modern measurement and control systems are essential. Based on the challenges of our time, e.g. owing to rising energy costs or the demand for emission reductions, revamping projects are more quickly budgeted and approved compared with new investments with their usually higher costs. This development is still supported by the increasing trend towards ever higher-grade sanitaryware products in terms of size, functionality and design.