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ATHANASSIOS KALIUDIS

Clean Baking - With Laser!

Haas Equipment GmbH has found an alternative way to clean its industrial waffle irons by replacing dry ice, chemicals and brushes with light.

Millions of wafers in different shapes and sizes are produced each day in thousands of wafer baking ovens in industrial and wholesale bakeries around the world. Many of these machines are manufactured by industry giant Haas Food Equipment GmbH, an Austrian company. In a highly automatized process, one of their standard production line ovens bakes an average of 2,500 wafer sheets per hour between 80 sets of baking plate pairs each with a surface area of 35 by 50 centimeters.

Inside each wafer baking plant, an endless chain of baking plate pairs moves through the oven without stopping. After each plate is filled with batter, a second plate closes over the top and the batter-filled pairs of plates are sent through the oven to bake the batter into wafers. After baking, the plate pairs are separated and the wafer sheet is transported to a follow-up machine for further processing. In order to maximize productivity, operators regularly clean the baking plates to make sure the wafers don't stick to their finely structured surface and stall the entire process.

Many options, no clear winner

Until now, preferred methods for cleaning the waffle irons involved using chemicals, dry ice or brushing by hand. "Each of these tools has its advantages, but also comes with at least one decisive drawback," explains Dr. Georg Kalss, who is responsible for materials technology at Haas. "Chemical cleaning is bad for the environment and too expensive. Brush cleaning takes too long and isn't very reliable. That leaves dry ice blasting, which is similarly expensive and damages the surface structure of the baking plates." All this drove the Haas engineers to go looking for a new method, one that is quick, environmentally friendly, energy efficient, reliable and gentle on the baking plates.

Our laser cleaner gives customers a tool that offers them all the advantages of previous cleaning methods without any of the drawbacks.

Dr. Georg Kalss, responsible for materials technology

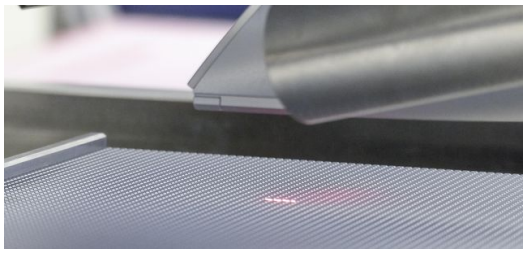
"Our research into what was available on the market led us to discover lasers as a possible tool. Since our production department had just acquired a laser cutting machine from TRUMPF, we decided to make the most of this contact and approached TRUMPF with our idea," Kalss remembers. Michael Dienstl and his colleagues from TRUMPF's laser technology sales department in Austria set about finding a suitable laser and invited the Haas team to come and see it in action at TRUMPF's demonstration center in Ditzingen. Kalss was convinced by what he saw – the laser cleaned the plates completely and without causing any damage. Pleased with these results, Kalss took the laser back to Haas in Austria for further testing, where he found that the cleaning process went just as smoothly, but took far too long.

"Initially, we selected a fairly low-power laser to ensure that the baking plates wouldn't be damaged," says Michael Dienstl. When Haas told us that this laser was too slow, we sent a new, more powerful one." The new laser with an average power consumption of less than 500 watts and a peak pulse power of up to 20,000 watts applied to the plates got the cleaning done much faster. Despite its higher power output, this laser also cleaned the baking plates without attacking the baking surfaces or damaging the distinctive grid structure that lends wafers their typical appearance. "Using a special lens enables us to achieve a very large process window for the laser ablation. This means the laser is able to remove fatty residues and left-over batter from both the hills and valleys of the baking plates," explains Dienstl.

Little room between the plates

Having now found the right tool and process, the next step for Kalss was retrofitting the laser for its new day job as a cleaning agent in a wafer factory. He called on systems integrator Robert Binder to help him solve a seemingly contradictory problem. "In our ovens, the baking plate pairs only open up to an angle of 30 degrees. This prevents excessive heat loss when the batter is poured in or the wafer sheets are removed," says Kalss. "But in order to clean our ovens, we require the surfaces to be as accessible as possible."

Despite the lack of space between the baking plates, the laser cleans them quickly and reliably. Picture: Maria Haas



Efficient, environmentally friendly and reliable – the laser cleaning tool from Haas. Picture: Maria Haas

Dr. Georg Kalss, responsible for materials technology at Haas. Picture: Maria Haas

With help from the systems integrator and experts from TRUMPF, Kalss and his team began by optimizing the laser's beam in such a way that it could be operated as far away as possible from the machine and still provide enough power to clean the baking plates. Laser head, laser and power supply are all attached to a cart that is connected to the wafer oven. Several translational and rotational servo axes then maneuver the laser head between a set of two baking plates to begin cleaning. Instead of completely cleaning each plate one at a time, the baking plates move through the oven in a continuous chain just as in usual service while the laser cleans each plate in strips. Once this same section has been cleaned on every plate, the laser

repositions itself and starts again, cleaning the next strip on each plate passing through. Any particles blasted off during cleaning are sucked up and filtered out of the air by another device.

Fast and reliable

The chain of baking plates makes about 70 circuits through the oven before all the plates are clean. "For an average oven, the entire cleaning process takes about one to two shifts to complete," Kalss explains. "This represents a considerable time saving when compared to manual or chemical cleaning, which takes about three to five full days to complete for a machine of this size." But saving time is just one of the advantages offered by the laser – its low power consumption means it is considerably more energy efficient than a dry ice blaster, added to which it generates zero waste.

"Without doubt, the high process reliability of the laser cleaning method is another huge advantage," says Kalss. "Using the laser cleaner allows us to document the entire cleaning process for the first time, and so determine and analyze any potential room for improvement. At the same time, we can ensure the entire surface has been cleaned to a high quality, premium standard." Furthermore, the laser's manual laser power calibration (LPC) allows the most effective laser power setting for the process to be selected every time.

Haas will be debuting its new laser cleaner at the 2014 interpack trade fair from May 8-14 in Düsseldorf. Kalss is sure of its success. "Our laser cleaner gives customers a tool that offers them all the advantages of previous cleaning methods without any of the drawbacks."

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