

THE OCRIM REVOLUTION FOR CUTTING-EDGE MAINTENANCE

# TITANIUM ROLLERS

by Eloisa Martino, Marco Galli and Daniele Rossini, Ocrim S.p.A, Italy

Titanium rollers

**T**he correct operation of an entire milling plant is determined by many factors, including some related to the design, the performance of all the machines, as well as correct and timely maintenance. Ocrim has studied and designed the best way to optimise and enhance the mill's operation, linked to the performance of the rolling mills, in order to optimise

both time and maintenance costs. This led Ocrim to focus on the grinding rollers, designing a solution that would incorporate as many benefits as possible for the end user.

For this market request, the solution presented by Ocrim involved including titanium coated rollers for the fluted passages in the grinding process, ensuring a much longer life of the rollers currently used by the entire milling industry. The Ocrim Research & Development Department, following this new engineering strategy, carefully studied the results related to the titanium coating of the rollers, in order to be able to share with its customers the important opportunities that this innovative product can offer.

The wheat grains are crushed to obtain flour and semolina, thanks to a combined action, involving grain cutting and its compression. The diagrammatic study to obtain the best possible yield from the plant is strongly affected by the state of the fluting of the rolling mill rollers. With new fluting it is possible to

obtain the nominal yield of the plant because it is in the best conditions to achieve what is envisaged by the diagram, therefore it is crucial that the profile of the roller fluting is maintained for as long as possible.

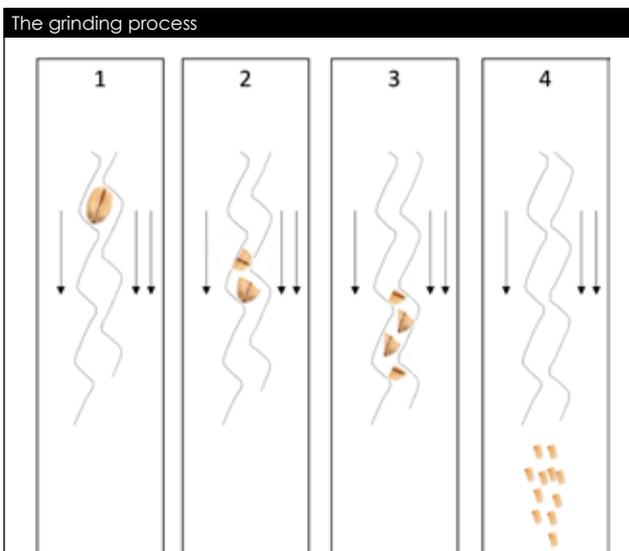
The grinding rollers are all made of chilled-iron cast alloy with different hardness, according to the requirements or the technological diagram. The duration of the roller is thus directly dependent on its hardness. The fluting of a cast iron roller is preserved and, therefore, maintains its characteristics for longer when the roller has high hardness values (e.g. 530 HB).

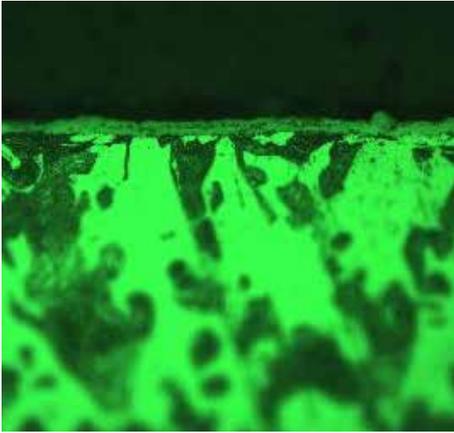
In this regard, the Ocrim Research & Development Department has conducted several research studies and trials, achieving tangible results through the application of a special titanium coating for the corrugated rollers. This coating causes a considerable increase in the surface hardness values and consequently increases the duration of the fluting over time, to keep the ideal configuration of the plant as unaltered as possible.

The titanium coating of the rollers is carried out using cutting-edge technology, called Plasma Assisted Chemical Vapor

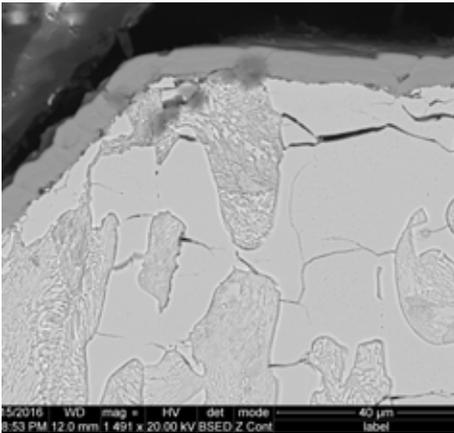
Deposition (PACVD), which ensures the best possible results. This sophisticated operation consists in creating a multilayer coating, for a total thickness of about three microns of titanium nitride (TiN) and titanium boride (TiB). This ensures the combination of the best characteristics of the two materials: the high hardness of the TiB and the low coefficient of friction of the TiN.

Given the very low thickness of the coating, one cannot talk about the





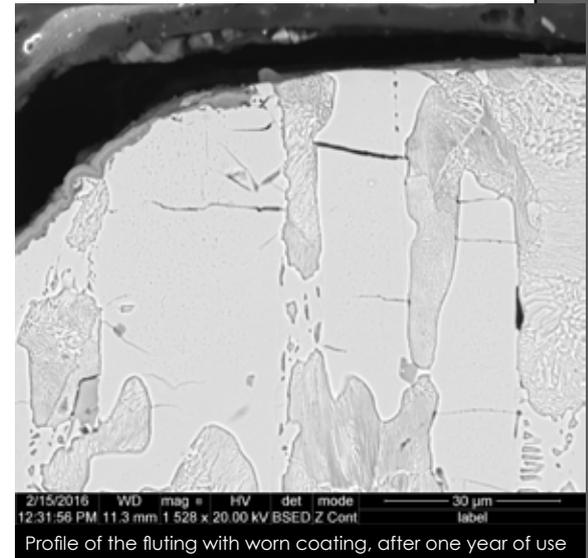
**Above:** Surface coating on a flat surface...  
**Below:** Surface coating on the fluting



hardness of the roller, but of the surface hardness of the roller (microhardness) which reaches the significant value of 2200 HV, which is four times higher than the hardness of the commonly-used traditional rollers, which can reach up to 560 HV (in the best cases).

The titanium coating, protecting the points of greater operation/pressure, ensures greater resistance to wear, while in the other points it maintains its characteristics, providing protection against oxidation and reducing the surface friction of the product. All this leads to considerable savings in energy and maintenance costs.

In order to scientifically demonstrate the validity of this solution and application on working machines, the wear was simulated by means of two cylindrical specimens, rotating at two different speeds, placed in contact under a controlled load. The test showed how the uncoated cast iron specimen starts to wear out (to lose material) from the beginning, while the titanium-coated specimen suffers negligible wear during operation. Once the layer of coating material is worn, the wear continues at the same speed as the uncoated specimen.



Profile of the fluting with worn coating, after one year of use

Downstream of the laboratory test, a field test was conducted at an important Italian mill. After installing the rollers and adjusting them, it was requested not to make further adjustments until the next check. The passage under examination showed an average granulometry of the incoming product of 1368 microns.

With new rollers the average granulometry of the outgoing product was 885 microns, after 100,000 tonnes of processed product the granulometry shifted to 950 microns. Despite the high production, the average outgoing product granulometry value has not changed much, synonymous with an insignificant wear of the roller, unlike what would have happened with traditional cast iron rollers.

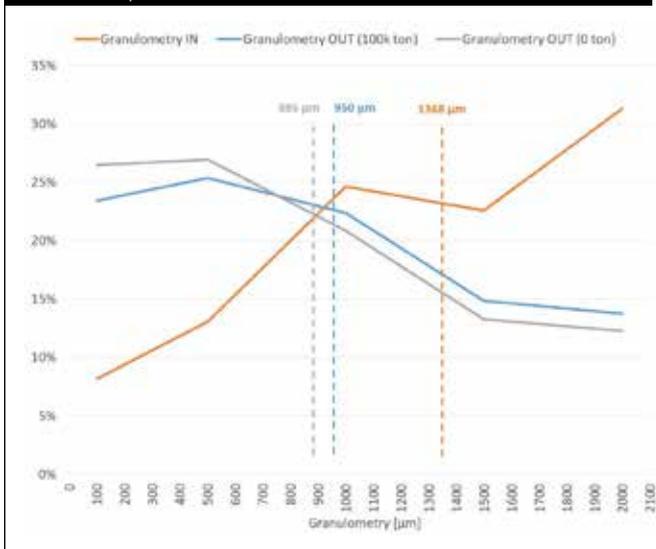
To support the above, Ocrim has used an innovative contactless electronic device, developed by the Ocrim Research & Development Department, which quickly assesses the state of wear of the corrugated cylinder. Thanks to this device, the technologist can decide whether or not to renew the fluting, because the (portable) sensor rests on the cylinder and is able to instantly detect the percentage of wear, compared to the new cylinder.

### Results and conclusions

Based on the “field” results obtained, the rollers with titanium coating are therefore economically more advantageous than the traditional ones, since they last longer. The longer life of the titanium-coated rollers, although with a higher starting cost, results in the following:

- Savings, in terms of time and maintenance costs, because with this technology, Ocrim guarantees, in a B1 passage, an average duration of about three years with no maintenance
- Fewer plant stops to change rollers, which involve loss of productivity

Granulometry trend



- Lower costs for the renewal of fluting and/or the purchase of new rollers
  - Reduced plant yield losses, which instead inevitably occur with traditional rollers due to faster loss of their fluting profiles.
- From the analyses carried out already with a production of 7200 tonnes per year, considerable savings are obtained by using titanium-coated rollers, confirming the validity of this new Ocrim product.
- The Ocrim titanium-coated rollers are already fully in production and on the market and are already used by many customers in their plants, with full satisfaction and with results that exceeded expectations, as they are even more satisfactory than the tests conducted.