AMC® Advanced Mould Coatings

KME Germany GmbH & Co. KG
AMC® – Advanced Mould Coating
[EN]

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Copper materials have a relatively low hardness and thus low resistance to abrasive wear. For this reason, a high degree of wear can occur in the lower part of the mould where the strand shell has hardened. To counteract and improve the service life of moulds, KME has developed advanced mould coatings.

The continuous casting of steel has seen major improvements in casting speed and product quality over the past decades. For further improvements in both product quality and productivity high-grade mould materials and special custom-designed coatings are of key importance.

Intensive research and development as well as field trials in the past years have brought forth new mould coatings whose sets of properties have been optimized for high-stress applications. These coatings do make it possible for the economics of continuous casting to be further improved.

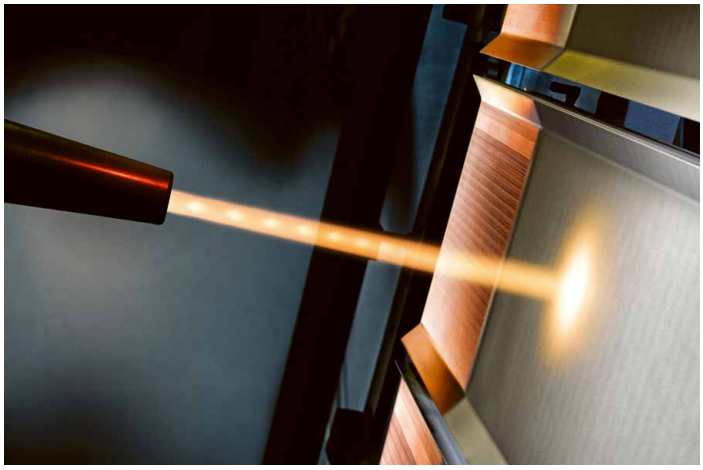
Today, high-hardness Ni alloys and ceramic-metal coatings are state of the art. Depending on application-specific conditions, both systems enable further notable improvements to be achieved in the service life-cycle of moulds.

AMC® – HN 20 / HN 40

Nickel coatings are preferably used for the hot face of wide-face and narrow-face mould plates. As regards the latter, the edges in contact with the wide faces are coated with nickel too.

A HN 20 nickel coating already affords much better wear resistance than a plate without a coating. The HN 40 nickel alloy has twice the hardness of HN 20 and better elevated-temperature strength so that, compared with standard Ni coatings, this type of coating considerably enhances the performance and lifetime of moulds.

Thermal coating



As there is little difference between the thermal characteristics of standard nickel and AMC®-HN 40 coatings there is no need to adapt the cooling and casting parameters when using AMC®-HN 40. Both types of coating can be applied in greater thickness so that they can be remachined several times.

AMC® – HWR

HWR coating is, same as the nickel coating, applied by a galvanic process which allows different coating thicknesses with the possibility of several re-machining between the re-coating cycles. The essential benefit is even if the hardness of the HWR (240 HV) is just 10 % higher as a standard AMC®-HN 20 nickel coating (220 HV) the hardness behaviour: While the standard nickel and nickel cobalt coatings could lose their hardness properties because of the heat influence during the casting, the primary hardness of the HWR coating keeps stable.

This effect protects the bottom part of the plate against abrasive wear even better and avoids horizontal scratches caused by width change in the hot meniscus area. Because of the stable / increase hardness vertical imprints on wide face plates caused from the narrow plates can be reduced. HWR offers also a better protection against zinc diffusion. Standard nickel coating may be attacked from zinc (coming from the liquid steel) leading to cracks especially in the meniscus area. This effect can be reduced with HWR.

AMC® – HC 90

AMC®-HC 90 is a standard chrome coating used preferably for mould tubes. For slab moulds in certain high stress environments AMC®-HC 90 as protective coating can be combined with nickel.

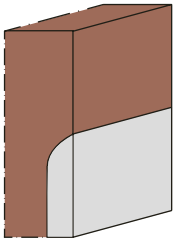
TOPOCROM® coatings

In addition to the well proven AMC®-HC 90 chrome coating, KME can also furnish mould tubes with TOPOCROM® coatings. The textured surface of this type of coating makes it possible for the frictional forces between the strand shell and mould wall to be reduced.

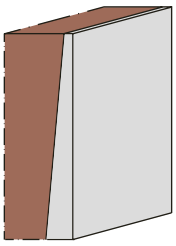
TOPOCROM® coatings have shown less wear under abrasive test loads. This effect can be used to improve the lifetime of mould tubes.

AMC® – HF 120

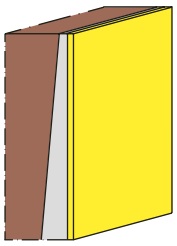
Thermal spray systems make it possible to apply ceramic-metal or ceramic coatings. In the course of the development work technologies originally developed for the aircraft and turbine manufacturing industries were transferred to the coating of mould plates.



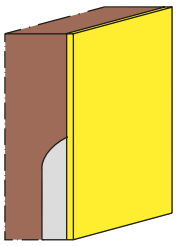
2.0-6.0 mm HN 20
or 2.0-3.0 mm HN 40



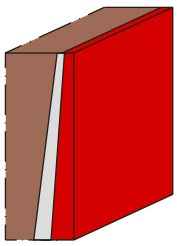
1.0-3.0 mm HN 20
or 1.0-2.0 mm HN 40



1.0-3.0 mm HN 20/40
+ 0.025-0.05 mm HC 90

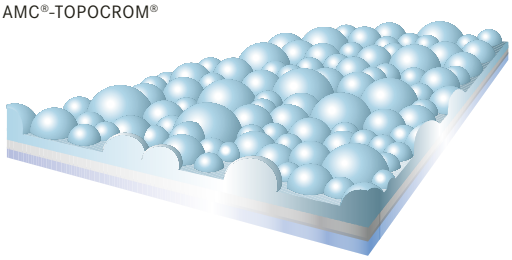


2.0-6.0 mm HN 20
+ 0.025-0.05 mm HC 90



0.1-0.6 mm HF 120
0.1-1.0 mm HN 40

AMC®-TOPOCROM®



Material	Hardness HV	Thermal conductivity W/(m·K)
AMC®-HN 20	220	90
AMC®-HWR	240	80
AMC®-HN 40	400	80
AMC®-HC 90	900	70
AMC®-TOPOCROM®	900	70
AMC® HF 120	1200	30

The advantages of the new coating technology are considered to be in:

- high particle velocity making it possible to produce dense, low-porosity deposits;
- the sprayed material making an excellent bond with the substrate metal, for good coating adherence;
- low thermal stress load being experienced in the sprayed material.

Further improvement and refinement of the systems in combination with sophisticated forms of process control and the employment of robot systems and specially engineered coating materials are now making it possible to offer advanced mould coatings with excellent tribological and mechanical properties.

Laboratory tests

New developed ceramic-metal coatings, in contrast to electroplated coatings, enable users to benefit from outstanding properties such as, in particular:

- high hardness
- high resistance to wear
- good adherence
- dense, low-porosity deposits

These points have been optimized in the course of extensive laboratory experiments and studies. To achieve this it was necessary for the process technology, spraying parameters and coating material to be adjusted to one another for the best possible result.

Tribometer test series made it possible for the wear characteristics of the different coatings to be studied under defined conditions in the laboratory. The „Taber/Abraser“ has got two grinding wheels which rotate (see schematic). The degree of abrasive wear per number of cycles is measured in terms of the difference in weight. The result for the AMC®-HN 40 nickel alloy shows a notable increase in wear resistance over that of KME's tried and tested standard HN 20 nickel. The readings obtained from this test also go to show the greater hardness and much better wear resistance of thermal spray coatings.

Practical application of the coatings

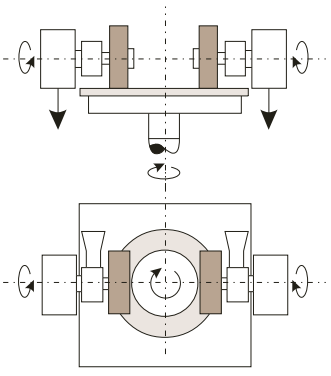
The thermal spray coating AMC®-HF 120, which feature different sets of properties, make it possible to achieve further reductions in mould wear and/or wear at the edges of narrow-face mould plates.

Its extremely low abrasive wear makes AMC®-HF 120 the preferred coating for the hot faces. Tests done with narrow-face plates have demonstrated its excellent in-service performance. In some cases it may be impossible for the technical potential of spray coatings to be fully exploited.

The facial wear may be extremely low, but the handling of mould plates with these coatings requires much greater care and attention in order to avoid local damage. It is in the nature of very hard (coating) materials to possess lower ductility than electroplated nickel deposits, and this is where that typical property makes itself felt. Thermal conductivity decreases as hardness increases, and spray coatings do feature low conductivity values. But this remains without any negative effect, even in the case of full-surface coatings, since deposits a few tenths of a millimetre thick are not acting as a major heat flux barrier.

On the basis of initial test runs under normal shop-floor conditions mould life can be expected to increase by a typical factor of 3 to 6, the reference basis being hot face coatings of AMC®-HN 20 and AMC®-HN 40 which do of course last much longer already than plates with no coating at all.

Tribometer-Test
(view from the front side)



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