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Cost savings and higher product quality with water-based coatings

Using water-based mould coatings from ACMOS offers numerous advantages including environmental and safety benefits, extending the life of the mould and producing a higher quality product, says Marina Littau.

Mould coating is a part of a standard process for many container glass manufacturers, but there are still some markets where moulds are not coated at all, or only partially, even though this additional step has many advantages in for process and quality.

Besides the automatic lubrication systems, which are already accepted and used in practice, the implementation of mould coatings represents a further opportunity to reduce the use of lubricants, making the process safer while at the same time achieving significant cost savings through a reduced rejection rate.

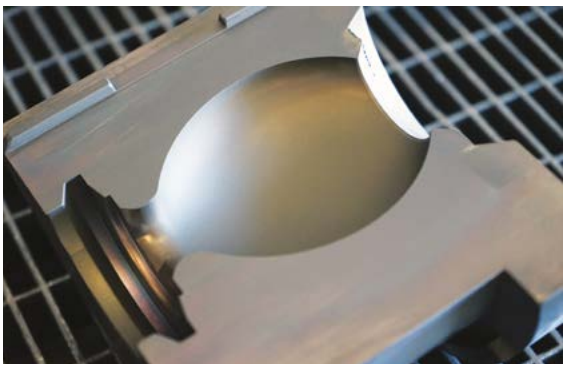
ACMOS Chemie KG is a manufacturer of heat-resistant coatings, lubricants and release agents, cleaners, and other process auxiliaries for the container glass industry. As a specialist in water-based process chemicals, ACMOS develops and produces coatings with active substances that are dispersed in water as a carrier medium. Water-based coatings significantly reduce risks to the people and the environment by substituting organic solvents for water. For environmental and personal safety reasons, water-based products are increasingly being used in the container glass industry.

The advantages of water-based coating are obvious when looking at the labelling: a solvent-based mould coating is labelled with numerous pictograms along with hazard or safety information, such as H226 'Flammable liquid and vapour' and requires cautionary measures during its application. In contrast, ACMOS' water-based coatings are not classified as hazardous.

Longer life and lower costs

In addition to the environmental and safety aspects, [water-based] mould coatings offer many process advantages and lead to an improvement in the quality of the final product, which are illustrated in the Figure 1.

Studies have shown that mould coating can double, and in some cases even quadruple lubrication intervals. If the moulds have been pre-coated, there is no need for lubrication, which can be seen as a disruptive factor in the production process, for about the first 20 minutes after a job change. So, the operators gain time to start the process, to overcome initial difficulties and to achieve higher output from the machine. Also, during the entire production, lubrication intervals can be significantly extended, and mould lubrication can be kept to a minimum due to a lubrication buffer that the coating provides even several hours after a job change.



A coated perfume bottle mould.

As the measurement data in Figure 2 shows, the mould coating wears off continuously in the first 20 minutes after a mould installation, but after 20 minutes the wear slows down, so even after 60 minutes at least 50% of the initial layer thickness is still present and thus mould coating continues to function.

It has been observed that a well-adjusted drop cut and a central drop fall have a significant impact on mould coating durability (see Figure 3). If the drop hits the mould wall first, there will be a strong mechanical load at this point due to friction between the glass gob and the mould coating, which results in an early wear of the mould coating and an increased need for lubrication. Once the drop is adjusted correctly, the service life of the mould coating and therefore the lubrication intervals can be significantly extended. Longer lubrication intervals save not only lubricant consumption, but also ensure a longer mould service life, as the less lubricant applied, the lower is its build-up and contamination in the mould.

Extended lubrication intervals also reduce the rejection rate, having a direct positive impact on total costs. This is particularly evident for articles with a high mould change frequency. ▸

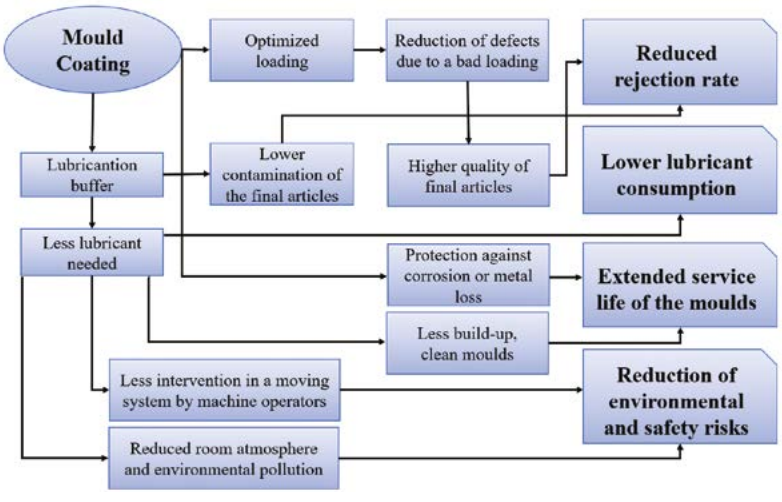


Figure 1: Advantages of using a mould coating.

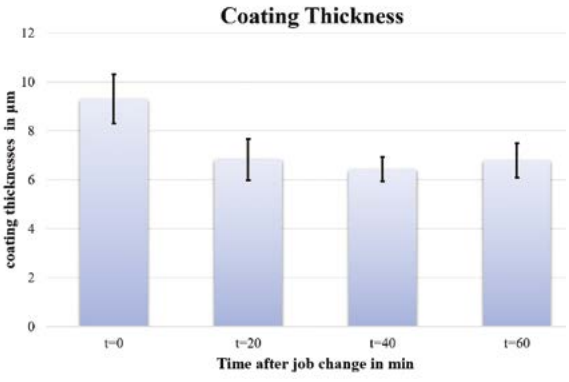


Figure 2: Coating thickness depends on time of the mould in production.

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Increased safety and product quality

In addition, there are reduced risks in personal safety because of a reduced intervention of operators onto a moving machine. At the same time using a mould coating can also reduce room atmosphere pollution caused by vapour generated during lubrication.

But a mould coating can do even more: the quality of finished articles can be significantly improved. Studies show that by combining the coatings with the usual lubricant, the rejection rate can be reduced significantly. The sliding of glass (gob) and metal (mould surface) as a tribological system causes friction and wear, which has a negative impact on the load and therefore on the article surface. This negative effect is shown by defects such as loading marks, washboards, or cracks. With a mould coating, problems in loading and article defects mentioned above can be avoided, which also has a positive effect on other quality parameters, such as bursting pressure.

Further, a mould coating protects the mould surface against corrosion or metal loss – both have a positive effect on the quality and service life of the moulds and reduce maintenance and purchase costs.

Coating composition

ACMOS offers a wide range of mould coatings available as bulk material and in spray cans. The user can choose between universally applicable coatings or products developed for a specific mould area, such as neck rings.

The chemical structure of ACMOS mould coatings is very similar to conventional lacquers, whereby the consumption of the sliding layer as a wear layer is intended, and the conventional lacquer is designed for longevity (see Figure 4).

ACMOS mould coatings are also called solid lubricant systems because they are based on solid lubricants, such as graphite, boron nitride, aluminium, or molybdenum sulphide, which are integrated in an organic or an inorganic binder system. Due to a high temperature load, only high-temperature resistant systems such as silicones and inorganic binders can be used as binders. Solid lubricants, binders and additives are dispersed in water or solvent.

The fineness of ACMOS coatings is ensured by using a grindometer, following the ISO 1524:2013 method for determining the fineness of grind of paints, inks and related products.

One of the biggest challenges in the production of such mould coatings is to ensure a certain grain distribution and the formation of an even layer on the mould surface at the customer side. To meet this challenge, ACMOS uses state-of-the-art dispersion technology and continuously optimises its manufacturing methods. The company has successfully demonstrated its blank mould coating process for perfume bottle production at Heinz Glas, manufacturer of glass flaçons for the perfume and cosmetics industry.

Application of ACMOS coatings

To take full advantage of a mould coating, ACMOS advises paying special attention to product choice. The optimal mixture of active ingredients and the kind of coating depends on the article type and mould area to be coated. In the case of blank moulds, bottoms and neck rings should also be coated because the benefits of a coating are particularly effective in these areas. The final moulds can be coated completely or in areas of engravings only to minimise checking and cracking issues in these problem zones.

The type of article, production speed as well as other process parameters have a significant impact on the service life of a coating which can be considerably extended using ACMOS lubricants as they are matched to each other and fully develop their advantages in the production process when used together.

The performance of a coating does not only depend on the product selection, but the correct application is of great importance (see Figure 5). ACMOS recommends paying special attention to the following process steps:

First, moulds must be properly cleaned. A metallically clean and grease-free surface is a basis for an optimal application and a long service life of the coating. Blasting with abrasive material (sand, metal balls, glass beads) is the usual method and is also recommended by us. If the mould surface seems to be too rough after blasting, it can be repolished. Before

Figure 5: Process steps required for an optimal coating application.

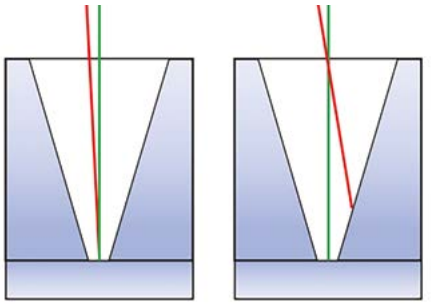

Figure 3: Schematic representation of an optimal and a bad drop load.

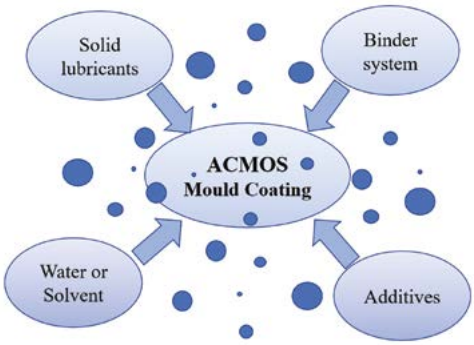

Figure 4: Schematic representation of a mould coating structure.

coating, a chemical cleaning or degreasing is recommended to eliminate possible dust and grease residues.

For initial trials, the use of spray cans as a possible delivery form of the ACMOS coatings is suggested to be able to test the coating without having to invest in application technology. After that trial stage, however, the use of bulk products should be considered for environmental and cost reasons – but return on investment can be achieved in only a few months. ACMOS is happy to advise on selecting the best application technique for your process.

An important aspect that is often overlooked is the stirring of the container content before applying the coating. For spray cans and smaller containers, this can be done by shaking it manually; for containers of net 5kg or more, a stirring device should be installed.

After the mould surface is free of dust and grease, you can spray the coating on the shaping mould surface as well as on the space between the mould halves double and crosswise, but in very thin layers. The motto 'less is more' applies here. Our experience shows that coating thicknesses of 6–7 microns are sufficient. Extra thick layers are rather counterproductive because they can spill off the moulds after the curing process.

After a double and crosswise application, the coating must be polymerised at a temperature between 300°C to 400°C for approximately one hour. Preheating ovens are frequently used and are well suited for this purpose. The volatile components of the coatings flash off and do not lead to any room atmosphere pollution in the production. Later, the mould can be preheated and installed as usual. ●

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