



DIE HEAD COATING

Advanced Coating Solutions Oy

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COATING WEAR

A die head is a core component of a film blowing machine. Its proper functioning is crucial for the blown film quality and production performance.

As we turn to circular economy, plastic manufacturers change their recipes to process recycled raw materials. Naturally, recycled materials are coarser than new raw materials. It cannot but effects the surface of the die – the coarser the plastic dough is the



The coarser the plastic dough is the faster die's surface wears off

faster die head's coating wears off.

What does it mean for the production line?

It causes clogs of the molten material, burns of polymer, poor quality of the film, excessive use of additives, excessive friction, energy costs, etc. Subsequently, production shall be frequently stopped for cleaning and other maintenance operations. Needless to say, this is inefficient and pricey period for the production line.

To avoid the above issues the die head coating shall be kept in the best possible condition. The worn-out or damaged coating shall be refurbished.

Question is how, where and what coating to choose.

PTFE TO PVD COATING

Choice of coating depends on the die's base material as well as production recipes, scale, and goals.

There are various coating options available in the market: chromium plating, nickel plating, PVD, etc. The search of the right solution might take some time, if there is nothing to compare with or due to lack of experience in these matters.

We had an interesting case in our practice. A blown film manufacturer was in search of a non-stick solution for their production line. They ended up trying polytetrafluoroethylene (PTFE) for their 3-layer die head. After few months of use they faced the following issues: manual cleaning only, easily damaged surface, risks of having damaged coating bits in the end product, etc.

This manufacturer has own pyrolysis oven for cleaning their

die heads. It was impossible to use the oven as PTFE could effect the die base material when heated (300-600C). It meant waste of resources and manual cleaning only.

The company contacted us for a consultation. We suggested to replace PTFE with PVD coating. As the PVD process transfers the coating material on the molecular level, it can provide extremely pure and high performance coatings which for many blown film production sites can be preferable to other methods used. The customer wanted to have their die back to the production site as soon as possible. It was a complex project due to timing requirements and number of manual and machinery operations that we had to perform.

First, we removed the polymer from surface and stripped the old PTFE coating manually for the above reasons. After couple days of manual labor we were able to use our pyrolysis oven to remove the residual contaminants. Following the surface inspection we proceeded to polishing. Polishing is a final stage before PVD process. Polishing took another couple days. This procedure gives the die an even and mirror-like surface prior to coating process as well as removes the remaining contamination if any.

After cleaning, grinding and polishing the die head was ready to be placed into the PVD oven.

The entire refurbishment process took 10 days. It should be reminded that we agreed with our customer on a shorter than usual refurbishment process period. Usually, the 3-layer die refurbishment takes up to 21 days depending on the workload.

EXPERT COMMENTS

Polishing is the last preparation stage before a new coating.

Coating requires even and mirror-like surface for smoothing of the surface and better adhesion of a new coating. A fine layer of the coating is only 10 um. So, it covers not dents, small crevices, etc. They need to be fixed in advance by grinding and polishing.

We use coarse and finer machines to even out all damages incl. surfaces of internal passages, until fine paste is applied. It finalizes the process, and surface obtains that shiny look.

The process time is difficult to estimate. It depends on many factors: initial look, condition, and size of the surface. Basically, less damage – faster process.

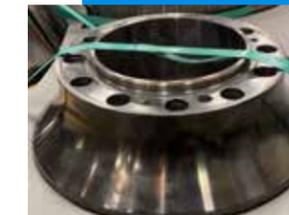
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Before



After



Before



After

PVD COATING BENEFITS

PVD coatings provide a number of benefits to die heads in addition to hardness and adhesion.

PVD process requires dust-free conditions and a perfectly smooth surface for coating. This is crucial for proper coating adhesion to the base material of the die.

PVD coatings provide a number of benefits to die heads in addition to hardness and adhesion. The most significant are:

- Improved wear resistance
- Reduced friction (CoF)
- Energy savings
- Extended life of dies
- More sustainable than traditional coating, etc.

The PVD coating provides the treated dies with superior characteristics than any other chemical or electro-chemical treatment and guarantees a greener finish with

minimized environmental impact.

If we compare the energy consumed to produce PVD coatings to the energysavings (they give through the improved efficiency and durability of a die head) we cannot but notice the generated return on investment.

Although we recommend PVD coating for its durability and ability to enhance operating performance and lifespan of the extrusion tools and die heads, the environmental impact is an important value-add that should not be underestimated.

Should you need more information or consultation on coating or any other ACS's services, please contact us www.pvd.fi.



PTFE coated



PVD coated



ACS Oy is a Finnish company, that operates in the field of machinery and engineering and specializes in service and maintenance of injection moulds, extrusion tools, die heads and other parts for the plastics and rubber industries both in EU and non-EU countries.

We provide a wide array of services: thermal cleaning, ultrasonic cleaning, 3D and material analysis, grinding electro- and mechanical polishing, and refurbishment.

For more information please visit our website www.pvd.fi.



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