The „Automated Die Polishing System“

Micro Stream®

for Aluminium

Unparalleled capabilities for extrusion performance and Die makers by fully automated Die polishing

- Used on new Dies, to refine EDM finish, and used Dies, to repolish
- Repeatable quality
- Attains surface finishes below 5 micro-inch (0.12 micrometre) $R_s$
- Can be used on solid and hollow-chamber Dies
- Significant savings in time
- Fast „Return of Investment“ (ROI)
- Fast and easy to operate
- Gives surface finish in same direction as material flow through Dies
The System's Components

Fully computer controlled processing

All Micro Stream® machines provide clamping and sealing of the Dies plus the ability to flow a preselected volume of a preset number of cycles.

Surface finishes are improved dramatically, with resultant small, controlled radii all around the profile. Two-way flow of the media obviously does not simulate the one-way flow of material in the extrusion process but users have reported no detriment in flowing both ways. They say that the very small radii produced are actually beneficial to the finish produced on the extruded profiles.

Tooling suitable for Micro Stream®:

- Extrusion Dies
- Compacting Dies
- Drawing Dies
- Pharmaceutical Dies
- Cold-heading Dies
- Glass & Crystal molds

Abrasive flow Micro Stream®-Technology can be used to refine finishes of both new EDM'ed Dies and dies that have already been in service. In either case significant savings in time, and hence faster turnaround in the die shop, can be realized.

Please note the upper and lower media cylinders. Abrasive media is pumped from the lower media cylinder through the Die into the upper cylinder. Between the lower Cylinder and the Die we have an AFM-Media Heat- and Cooling system (automatically). This guarantees repeatable surface speed and longer Media life. Flow is then reversed and media is pumped back through the Die into the lower cylinder. This is defined as a "flow cycle" and is used a unit of medium volume.
Automated System

The Micro Stream® Automated Die-Polishing System has been applied successfully to many types of Dies and moulds. The process utilizes a polymer-bases abrasive-filled media, which acts as a “flexible file”. When used on extrusion Dies the STREAMER® simulates the material being extruded, which enhances the Die quality considerably.

Key variables in the process are STREAMER® type, operating pressure, surface speed and medium flow. All are rigidly controlled for repeatability of results. This computer control enables close tolerances to be maintained and, because of its inherent flexibility, the process can be applied to a wide range of Extrusion Dies.

Fixturing

In most cases there is no fixturing needed for extrusion die polishing; the Die itself can be loaded into the machine directly. When the size of the Die or Die holder does not match the machine the fixturing normally consists of simple adaptor plates or rings. For small work (e.g. Pill Dies) a fixture can be made to accommodate several of the small Dies, thereby increasing productivity. In certain applications, such as coldheading Dies, tooling restrictors are sometimes needed for uniform polishing to take place.

Fixtures are made from a variety of materials. Aluminium and plastics, such as structural nylon, are used to reduce fixture weight. To properly apply Abrasive Flow Technologies to Extrusion Die Polishing, the “first law of AFM” should be stated: “A drading is greatest where media velocity is highest.”

STREAMER® (AFM-Medium)

The STREAMER® is the third basic element of Micro Stream®. The polymer-based abrasive laden media is the cutting tool of abrasive flow machining, and works by mechanical abrading, i.e. by grinding away material. Abrasive flow media is made by mixing abrasive grain into a flowable but firm plastic carrier which is called the media base. STREAMER® is specified by its media base viscosity plus abrasive size, type and quantity.

Viscosity is an important parameter in AFM. High viscosity (stiff) STREAMER® provide a very elastic matrix for the abrasive grain and provide the highest material removal rates per unit flow. Low viscosity (soft) STREAMER® provides a more flexible matrix and will flow through openings as small as 0.010 inch (0.20 mm) diameter. Special STREAMER® types for new Dies and for repolishing are available.
Customer testimonials:

- “Repolishing time for all Extrusion Dies has been reduced drastically. The average time for repolishing is now between 1-3 minutes in the machine, plus some time allowance for handling and cleaning.”
- “All surfaces, corners and slots are polished uniformly which give uniform surface speeds during the Extrusion Process.”
- “Improved surface finish on the Extrusion itself. Interestingly enough this improvement does not show itself until Dies have been abrasive flow machined several times, showing that the repeated uniform processing pays dividends in quality of product.”
- “Dramatic time-savings compared with manual polishing, in the order of 50 - 90 % reduction.”
- “The tooling is polished in the same direction as the material flows, giving inherent advantages.”
- “Abrasive flow machining removes very little material from the surfaces and therefore better accuracy of the profile is maintained and the tooling costs per unit of Extruded Product is reduced.”
- “Tooling cost per unit length of Extruded Product is reduced because of longer Die-life and higher throughput per repolishing cycle.”

Surface of Finish Readings before AFM (from Wire EDM) and after AFM on new extrusion Die: It can be seen from the above that significant surface finish improvement has been gained (0.71 to 0.09 micrometer RA – 20 to 3.5 microinches Ra). Also note the flat plateauing of the surface, with no evidence of „bell-mouthing“ or tapering at the bearings.

Test done by ALCAN R&D department shows: No way to do it better.