

Hard chrome coating proves its worth to filament processors

A German company has developed an improved method of coating the guiding parts and surfaces of filament processing machinery in order to decrease the damage and breakage to high-performance fibres, reports Nick Butler.

The numerous advantages of high-performance fibres make them a natural choice for a range of technical applications, such as the reinforcement of composites. Strength, low weight, and high resistances to chemicals and temperature, for instance, allow manufacturers to make textiles that can command high premiums, more than offsetting the high-cost of the fibres themselves.

However, to exploit these fibres fully, manufacturers have to learn how to overcome a range of problems associated with processing them. Oxidized polyacrylonitrile (PAN) fibres, for instance, have a great many potential advantages if used in flame-retardant (FR) fabrics, but their practical use to date has been negligible because of the damage they incur during conversion to yarn, although a novel spinning process may be about to turn this situation on its head.

Historically, spinners and weavers have had more success with carbon, aramid, ceramic, basalt and glass fibres, and have found ways to deal with these brittle materials, which are more prone to filament breaks, sticking and the formation of dust during processing than conventional textile fibres. The guiding surfaces of processing equipment, for instance, are usually treated to prevent the brittle fibres sticking to them. As well as protecting the fibres from damage and reducing downtime caused by filament breaks, such surface coatings also reduce the wear on the guiding parts themselves, extending the useful lives of such as thread guides, rollers and eyelets.

Nevertheless, there remains scope for improvement and filament processors will be interested in a development to be exhibited at *ITMA 2015* by Topocrom of Stockach, Germany.

In Milan, the company will explain that existing treatments involve shot- or sand-blasting the surface to roughen it before applying a hard chrome plate.

However, the subsequent plating is unable to fully smooth out the damage, resulting in a so-called "orange peel" surface. While representing an improvement compared with the untreated part, these microscopic structures can damage the filaments passing over them.

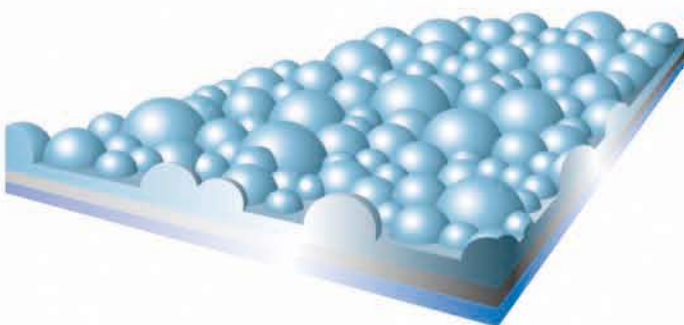
Topocrom's alternative is to apply a multi-layer coating directly to the ground base material (steel and steel alloys, stainless steel, cast iron, non-ferrous metals, copper and

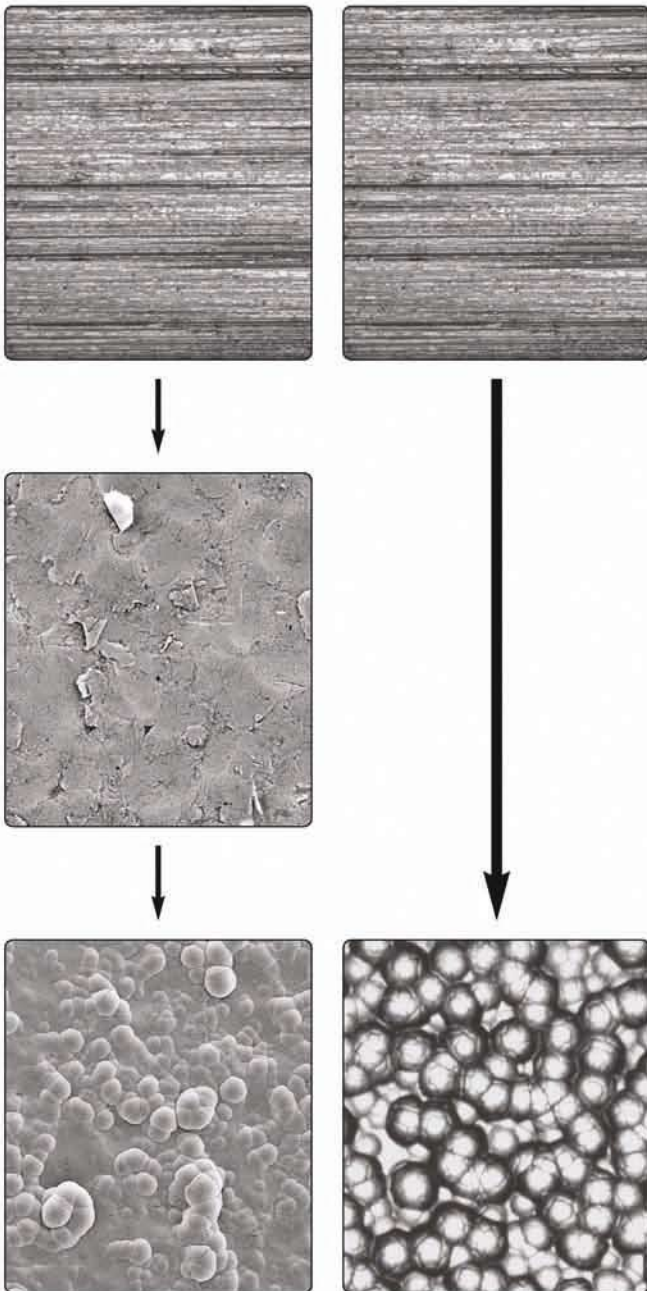
Advantages for fibre processors

Compared with rival surface treatments, Topocrom says its coating has a number of advantages for processors of high-performance fibres:

- treated parts are gentler on carbon, aramid, ceramic, basalt and glass fibres;
- fewer filament breaks;
- less formation of dust
- less sticking
- less wrapping
- better spreading
- better surface for the even distribution of fluids and their take-up by filaments;
- high resistance to wear, corrosion and abrasion (longer service life).

A multi-layer Topocrom surface has a number of hemispherical structures. The smooth domes help the filaments to slide and the air pockets that are trapped between these structures act as cushions, improving the tendency of the filaments to glide over and reducing the probability that they will stick to the surface. Further, by careful design of the topography, fluids applied to the surface can be encouraged to spread evenly between the hemispheres, leading to a uniform and rapid take-up by any filaments passing over.





Left: In a conventional process, the ground surface of the part (top) is first roughened (middle) by shot- or sand-blasting it. The subsequent plating does not completely smooth over the damage, leaving a so-called "orange peel" surface (bottom). **Right:** Topocrom is a single-step process and produces a smoother surface (bottom).

spheres to be controlled, as well as the thicknesses of the constituent layers.

As a result, Topocrom's engineers can create surfaces customized for particular functions; for instance, the engineers can tailor the topography of the air pockets that form between the hemispheres, maximizing their effects as cushions that help the filaments glide over the surface; similarly, fluids (such as sizings) filling these voids can be encouraged to spread evenly, ensuring they are taken-up uniformly by the filaments.

Initially individual parts are produced for testing and refinement of the surface treatment, before scaling-up the production to make sure the process is reproducible. As part of its quality control procedures, Topocrom tests the surface roughness, three-dimensional (3D) structure and geometry of the coating according to German, European and international standards.

By constantly rotating the component, and by controlling the charging and discharging of process fluids from a closed reactor, Topocrom says it is able to control the coating more accurately than is possible using a conventional approach with an open tank. Further, all the details of each customer-specific process profile (including the coating time, temperature and galvanizing process) can be stored digitally to ensure the tailored coating can be reproduced accurately at any time; the coating thickness and surface structures are reproducible to an accuracy of $\pm 10\%$.

copper alloys, aluminium and aluminium alloys, and titanium and titanium alloys), without any prior mechanical treatment. The company applies the coating in a closed reactor, laying down a wear-resistant metallic surface composed of hemispherical structures (mean radii can be in the range 4–60 μm), which form *in situ*.

The coating is hard (750–1200 HV) and temperature-resistant (it melts at about 1850°C), but its lack of sharp edges allows the treated part to guide and spread the filaments while causing minimal damage. Moreover, the process allows the height, quantity and surface density of the hemi-

Finally, worn parts can be de-chromed and re-coated immediately, without further machining provided the base component is undamaged, the company adds, making the treatment time- and cost-effective.



Further information

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