TOPOCROM® Texturing

Generation of defined roughness on sheet metal

TOPOCROM® is a hard chromium coating with astonishing properties. This reactor electroplating technology developed by the German/Suisse Company TOPOCROM® in co-operation with the Fraunhofer Institute IPA, Stuttgart, is an innovative solution to many industrial problems.

Texturing of working rolls
The surface structure of the sheet metal is a major quality feature of the product. It significantly influences the forming behaviour as well as the paint adhesion and the optical characteristics of the car body painting.

The defined surface structure of the sheets, produced according to the requirements of the customers, is generated during the skin pass rolling in the skin pass mill stand. Here the surface structure of the textured working roll is transferred to the cold – rolled or coated, galvanized sheet metal.

Structured hard chrome layer on working rolls
The TOPOCROM® surface texturing of working rolls is an electroplating process where structured chrome layers are deposited on the surface of the working roll. The TOPOCROM® roughness structure has a random, stochastic distribution. The TOPOCROM® layer is directly deposited on the grind- ed and cleaned surface of the roll body.

The TOPOCROM® texture for this application has three chrome layers. They are generated by different process parameters.

Conventional texturing methods deform the surface of the working roll plastically by shot blast (SBT) or by partially melting (EDT, EBT, LT).

Selectable roughness and amount of peaks
By changing the parameters of the computer-controlled hard chromium electroplating process the roughness of the TOPOCROM®-layer can be adjusted in the range of Ra 0,5 µm to Ra 12,0 µm and reproduced exactly. Also the amount of peaks Rp can be varied selectively. Compared to common texturing technologies it is possible to adjust an amount of peaks Rp greater than 100 1/cm.

Grinded working roll. Above: TOPOCROM® textured working roll

The essential characteristics of TOPOCROM® structured layers
– Hemispherical surface structure with absolutely stochastic distribution
– High variability concerning roughness, amount of peaks and structure (open to closed)
– High amount of peaks also with high roughness values

Open TOPOCROM® structure

Closed TOPOCROM® structure

Surface structure of Sheet Metal skin passed with TOPOCROM® rolls
Reactor-Technology

The plant for electroplating of working rolls is based on the patented and approved reactor technology.

This process has been developed by TOPOCROM® in co-operation with the Fraunhofer Institute for Manufacturing Engineering and Automation (IPA), Stuttgart.

The grinded and degreased working rolls are put down into the reactor with a crane. After closing the reactor with the reactor head the computer controlled process is started. This includes the hydrodynamic of the electrolyte, heating and cooling, the control of the electrolyte and much more. The process parameter of a TOPOCROM® layer is recorded and can be activated for a future production. Thus it is possible to reproduce exactly the surface structure desired by the customers.

Reliable, environmentally friendly and in conformity with the law

The plant meets the strict legal demands of different countries and also the high standards concerning the protection of environment and staff. Among others TOPOCROM® plants are installed in the steel mills of SALZGITTER (Salzgitter/Germany), POSCO (Gwangyang/South Korea) and ERDEMIR (Eregli/Turkey).

Advantages in the production of steel mills

The extremely high life time of the rolls even with high-strength steel is the result of the special structure and hardness of the TOPOCROM® layer. Example: with one pair of TOPOCROM® textured rolls it is possible to produce up to 40,000 tons of sheet metal in a Continuous Galvanizing Line (CGL) without changing of the rolls!

Only a very low decrease of roughness of the TOPOCROM® topography is observed during the operation in the skin pass mill stand. The hemispherical structure of the TOPOCROM® layer has a favourable effect on the stability of the surface. In this case there are no special mechanical forces on top of the topography elements in comparison to other topography types.

An obvious advantage of the multilayer structure is the hardness of the chromium layer.

Not the comparatively “soft” base material bears the main load of the skin passing process but the extremely wear-resistant chromium layer (thickness of TOPOCROM® layer about 60µm). The very low abrasion allows a schedule free rolling. A change of roughness can be neglected, thus it is possible changing the width in a wide range without a loss of quality.
Meeting the highest demands
The requirements of economic efficiency and quality required by the automotive industry are increasing steadily. TOPOCROM® meets these demands: Manufacturing accuracy combined with a constant quality of the sheet surface and a high life time of the working rolls. Also important are the low priced production costs of TOPOCROM® in comparison with EDT hard chromium.
A comparison of costs made by the steel mill POSCO has shown an advantage of 37% in favour of TOPOCROM®.

Advantages in the production process
Leading companies in the automotive industry have proofed an improvement of the formability and paintability of sheet metal thanks to the specific surface structure.

With TOPOCROM® structured sheet metal is sold successfully under the name of PRETEX (Salzgitter AG) and POSTEX (POSCO) to the automotive industry. This sheet metal is used in the car body production for inner and outer parts.

Capability of the customized design of sheet metal surface
- Improvement of formability and paintability
- The forming of a high account of closed lubricant pockets improves the formability and reduces the abrasion of the forming tool.
- The high account of peaks even at high roughness values as well as lower short and long wave improves painting appearance

3D-Surface-Parameters
The 3D-Surface-Parameters provide a novel approach to characterize surface structures. (Reference: Salzgitter AG, PRETEX-Feinblechoberfläche)

The 3D-Surface-Characteristic divides the force transmitted during the forming from the forming tool to the work piece into three contact areas (contact area of the material, contact areas of the open and closed void areas). Open void areas are areas from which the lubricant can escape during the forming process (picture above, blue parts). In regard to the tribological properties the closed void areas are more important (picture above, green parts).

Tribological properties
The closed lubricant pockets of TOPOCROM® texturing are located relatively high in the “roughness mountains”, therefore they can be activated early and diminish the friction forces during the complete process of forming.

In the automotive industry TOPOCROM® textured sheet metals are used for outer and inner car body parts with highest demands regarding formability and paintability.

Formability of different textured Sheet Metals
More closed void areas improve the tribological properties of the surface structure. Due to the high account of closed void areas of the TOPOCROM® structure compared to other texturing technologies extremely good tribological properties are confirmed by tests of the automotive industry.

Brilliant appearance
Generally the surface of PRETEX- and POSTEX are smoother than the surface of EDT. The illustration of the roughness of PRETEX or POSTEX shows definitely more peaks than EDT. These properties cause a brilliant appearance of the painting. On the other hand long-wave appearances are disturbing. Compared with shot blasted or spark eroded surfaces PRETEX- and POSTEX-surfaces usually show a reduced waviness therefore we get a better appearance of painting. By using a TOPOCROM® coated working roll in the last stand of the tandem mill these result can be improved.

Conclusion

TOPOCROM®: Features of structured chromium layers
– Hemispherical surface structure with absolutely stochastic distribution
– High variability of roughness, account of peaks and structure (open to closed)
– High account of peaks also with high roughness values

TOPOCROM®: Properties for texturing of sheet metals
– Very long life time of working rolls
– Constant high surface quality of sheet
– 30–40% lower manufacturing costs compared to EDT/hard chromium (Reference: POSCO)

Highest demands on sheet metal surfaces for painting process of car bodies

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