



Producer of the wire take up device in the background is the company MKB Emil Geitz GmbH in Hagen, Germany  
Photo: Staku-Anlagenbau

# Phosphate coatings on metal surfaces

Since the 30ies of the last century phosphated surfaces are used with growing success in primers and in cold forming processes.

Based on what is known today, especially electrolytical phosphating offers in pass through devices decisive advantages like very short treatment duration, lower consumption of chemicals and lower operation temperatures. This allows considerable increase of productivity with reduced operating costs at the same time.

Due to process and control engineering devices of the latest state of the art work more effectively and can be operated without any wastewater. Because of the electrolytical deposition during regular opera-

tion no reaction sludge occurs, that repeated cleaning of the device and disposal of the sludge is not necessary anymore.

Because very often in practice wire coils are temporarily stored after phosphating, corrosion protection is an item of big interest, too.

## Electrolytical phosphating systems

Zinc/calcium phosphating of today distinguish themselves by simple handling, robustness of the electrolyte and easy bath maintenance.

The cathodic set-up of the wire avoids pickling attack on the steel and thus produces no sludge causing iron ions.

As metal components only zinc and calcium are required, the dosage is normally done automatically by the device control. Due to direct current the layer construction is occurring simultaneously on many spots. Thus within shortest time very consistently distributed homogenous layers are achieved. The combination of calcium and zinc forms very fine velvet-like mixed crystals reaching a fast drying ►

Layer properties of phosphated surfaces			
Parameter	Zinc/calcium phosphate	Calcium phosphate	Bare wire
Entrainment after blow-off	21 ml/m <sup>2</sup>	27 ml/m <sup>2</sup>	8 ml/m <sup>2</sup>
Roughness of surface R <sub>A</sub> -value	0,68 μ	1,28 μ	0,29 μ
Rest humidity after blow-off	2 %	9 %	-

and a good corrosion protection, given by the share of zinc. The coating weight can be easily adjusted by amperage and retention time.

There have been many trials in the past to optimize phosphate layers. Up to now zinc/calcium layers have proven best.

Systems working completely without zinc in the phosphate layer were not able to establish. Calcium phosphate baths for instance tend in practice to sludge formation because the risk of precipitations during dosage cannot be kept under control sufficiently. The relatively high entrainment does neither permit an operation free of wastewater nor yield a sufficient corrosion protection of the treated wire surface.

**Layer properties and corrosion behaviour of phosphated surfaces**

Observation in practice show that zinc/calcium phosphate layers due to their very fine crystals cause little entrainment loss and dry fast (Table 1).

Pure calcium phosphate layers cause due to their obviously higher roughness (Foto 2) a higher bath entrainment, too. If the rinsing is not done very intensively acid rests are entrained into the following baths. In the case of a following soap bath this can lead to an acidosis within a few hours spoiling the whole soap bath completely.

Zinc compounds like zinc phosphate, zinc oxide and zinc chromate have been known as rust protection pigments for a long

time and have been established as corrosion protection. In numerous applications Zinc/calcium phosphate offers a good base for following treatment steps as well as additional temporary corrosion protection.

This property can be improved additionally in cold forming wire by smoothing down the phosphate layer in a calibration draw of approximately 10 % conversion. Wire surfaces coated with calcium phosphate have been observed to form rust after three days of storage in a production hall.

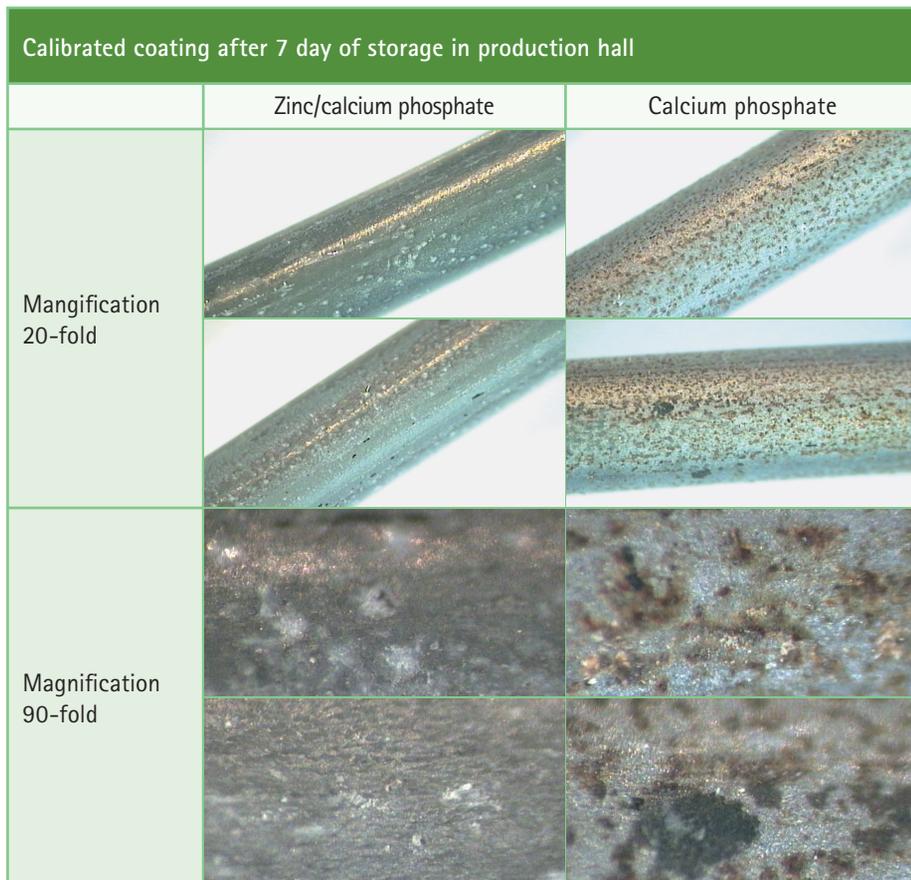
Wire coated with zinc/calcium phosphate showed even after 7 days storage time under equal conditions no corrosion.

**Result**

When a simple, but efficient process engineering with convincing layer properties is required, the user will decide on a device based on zinc/calcium phosphate. ◀

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**In visual focus**

After almost ten years of practical experience with Ephos devices and extensive knowledge in the electrolytical coating of wire Staku-Anlagenbau GmbH are counted among the leading specialists on this sector, too. Customers appreciate especially the work out of innovative and individual system solutions offering all necessary services from conception to running operation of the device to him. from one single supplier. The customer service department at Staku comprises chemistry, process engineering and technical service, at the customer's site, too. The lab department which was established since March 2006 especially for that purpose under management of Senior Chemist Wolfgang Knoll is equipped for all necessary lab tests.