

CERAMIX

NANOCERAMIC INDUSTRIAL TRANSPARENT E-COATING

DESCRIPTION

- Ceramic impregnated into the resin improving abrasion resistance
- No "Orange peel" defects on large flat surface areas
- Undetectable uniform film thickness
- 5-35 micron of thickness
- Stable for use in industrial production cycles
- REACH & OSHA Compliant

CERAMIX is a second generation, transparent nano-ceramic e-coating specifically designed for industrial scale productions. It is a hybrid resin impregnated with ceramic improving resistance to abrasion as well as other international normative testing procedures. The incorporation of the ceramic particles also provide a metallic sensation to the touch. Achievable thickness ranges of the coating layer cover from 5-35 micron while remaining completely transparent and undetectable. The resin matrix has been specifically studied to remove the "orange peel" phenomenon common when coating large flat surfaces. In production CERAMIX e-coating is extremely stable, more resistant to chemical contamination and does not underperform when impure or conductive water greater than 5 microsiemens is introduced to the bath.

DEPOSIT DATA

Hardness	4H
Thickness (um)	5 - 35 micron
Appearance	Completely transparent and shiny

PRODUCT FORM

Form	Ready to use liquid
Material color	White
Storage time	1 year after production; 4M since first opening date
Packaging	5 L

LIST OF CORRELATED PRODUCTS

CERAMIX-R	Concentrate resin for CERAMIX restoring and maintenance
3019001	Lactic Acid 90% solution for CERAMIX, 1 liter bottle
3019002	Solvent for CERAMIX, 1 liter bottle
CERAMIX-BR	Concentrate brightener additive for ceramix – 250 ml
3009010	Stripper for CERAMIX, 10 kg tank
3009018	"ECO" Stripper for CERAMIX, 5 liters tank
3009011	Rinse aid solution

SOLUTION PREPARATION

CERAMIX is sold in already ready-to-use form for this reason no preparations are required prior to start to work once the product has been put inside the working tank.

E-COATING LACQUER USAGE

	RANGE	OPTIMAL
Voltage (V)	20 - 120 V, maximum ripple 20%	
Current density (A/dm²)	Average 0.05 – 0.1 A/dm ²	
Working temperature (°C)	23 - 27°C	25°C
Treatment time (sec)	10 - 120	
pH	3.5 - 5.0	
MEQ corrected	25 -45	
Conductivity and solido content	300 - 600 µS at 25°C and 6.5 -7.5% solid content.	
Refractometric Index (°Brixel)	10.5 – 11	
Solvent (% w/w)	3 - 6%	
Anode/cathode ratio	Not higher than 2:1	
Anode type	Stainless steel AISI 316	
Circulation	Moderate, but Mandatory. In holidays or when not working for long periods transfer the solution to closed containers.	
Curing	Metal temperature 120-150°C for reasonable 30-45 minutes effective.	

The operation sequence to use properly CERAMIX ready-to-use lacquer is:

- pre-treatment,
- application of CERAMIX
- post-treatment
- stoving.

The pre-treatment is required to ensure absolute cleanliness and to obtain a surface free from water breaks. Articles which have been electroplated should obtain a final cold water rinse. Mechanically polished or untreated articles should be cleaned using the appropriate treatments. A typical process sequence is:

- demineralized water rinse, 2 x
- pre-rinse in demineralized water with 20 ml/l CERAMIX bath solution
- CERAMIX plate
- post-rinse in pure ultrafiltrate (permeate) or demineralized water
- demineralized water rinse, 2 x
- air dry
- cure

The purpose of the demineralized rinse is to prevent the lacquer solution from being contaminated. The pre-dip in dilute lacquer is considered essential in order to prevent film defects caused by gassing. The post-rinse is used to remove the lacquer solution from the coated object. Although a separate pre-and post-rinse is recommended, it is possible to use the pre-rinse also as post-rinse. The air dry stage is not critical, in fact some drain time is required to avoid excessive drag-out loss. During the stoving the deposited film will coalesce and cure. A gradual heat-up to the recommended metal temperature is preferred.

PROCESS EQUIPMENT

A full range of specially developed equipment is available from Legor.

All tanks in contact with lacquer solution should be of suitable plastic construction or of steel covered with acid and solvent proof lining such as rubber or polypropylene ("paint compatible", silicone-free materials and equipment throughout).

It is advised to use plastic vessels (PP) or glass (Pyrex).for lab stuff. Do not use stainless steel or iron not covered. The equipment should offer the basic requirements as indicated in the following sequence/steps:

- Ultrasonic cleaning with detergent
- Recovery with normal water (2 recoveries are advised)
- Electrolytic degreasing
- Recovery with D.I. water
- Neutralization
- Rinse in circulating D.I. water
- Final rinse with D.I. water
- E-coating treatment, stabilized at a temperature of 23-27° C, provided with a 30 to 120 V rectifier
- Post rinse in pure ultrafiltrate (permeate) or D.I. water
- Recovery (2 subsequent recoveries with D.I. water)
- Final rinse in D.I. water by mist spray in D.I water
- Final Rinse Aid (recommended)
- Drying to air (min 5 to max 30 minutes)
- Drying in furnace (120-150° C for 30-45 minutes)

If the plant capacity for the e-coating tank is higher than 150-300 liters, an **Ultrafiltration/demineralization unit** for the e-coating and the first recovery vessel is strongly suggested.

In particular the CERAMIX working tank should be fitted with:

- An overflow compartment.
- A circulating pump with a circulation capacity of 8 - 10 times tank volumes per hour.
- A filtration system through a 5 - 10 micron size polypropylene cartridges type filter is essential.
- A low energy (quartz) heater. Never use a heater that has a high heating power.
- Stainless steel AISI 316 anodes
- An ultrafiltration unit.

About the oven for the curing phase, re-circulatory hot air ovens or tunnel should be used.

An excellent system is a conveyor oven with temperature zoning in which the parts are heated slowly to the curing temperature.

NOTE: Box ovens require time to return to curing temperature when cold parts have been put in.

About plating racks: they must be made covered with normal PVC plastisol.

About rectifiers: use DC power rectifiers which are able to work in the range of 50 – 100 V provided of a function that permits to realize in case slow current ramps. For some specific work (like chains) some rectifiers able to reach up to 150 V are required provided with all the related safety devices.

Last but not least it is strongly **recommended to use adequate ventilation equipment** for the CERAMIX tank and for the working area in general.

BATH MAINTENANCE
CERAMIX e-coating lacquer

Emulsion level: restored regularly by adding cleaned D.I. water.

Water is lost by evaporation, the level in the overflow section should be looked by watching the solution level in the weir compartment, do not let the pump suck air because of too much low level.

Do not use the post-rinse solution for topping up.

SOLID CONTENT

CERAMIX emulsion contains 6.5 – 7.5% by weight solids.

In order to obtain stable performances, it is required to check the dry weight residue on regular basis. The dry weight should remain to 6.5 -7.5%.

It is recommended to run at least a refractometric analysis once a day, according to the use.

The more frequent is the use of the CERAMIX, the more frequent the check could be necessary. If the dry residue should be below 6.5%, it is necessary to replenish the suspension with 15-17 g/l of concentrated resin CERAMIX-R for every percent of dry weight below the reference value (6.5 – 7.5%). The concentrated replenisher consists of the pre-mixed concentrated resin, ceramic CERAMIX-R.

The best method of addition is to premix the required amount of concentrate resin with the working solution in a separate container.

Preferably additions are done at the end of a production day.

IN CASE OF LACK OF BRIGHTNESS

In case a lack of brightness is noted with respect to the starting condition, even after standard resin addition, it will be possible to restore it by adding the suitable brightener additive: **CERAMIX-BR**. This product is thought for e-coating lacquer installations which volumes are higher than 100 liters and for medium-big size production scale. CERAMIX-BR integrates those components that are lost from the e-coating paint emulsion due to the normal consumption, affecting the brightness of the obtained deposit. The guideline on how to use CERAMIX-BR is the following: a pre-calibrated charge of 250 cc CERAMIX-BR must be used per every 100 liters of e-coating bath when the same works continuously 5 day a week and for 8 hours daily. In case of different situation please contact our Technical Assistance Service for better guidance. CERAMIX-BR must be inserted very slowly into the weir section of the working tank.

SOLVENT CONTENT

Solvent is lost by evaporation and drag-out. Normally the solvent level is maintained by the addition of the CERAMIX-R concentrate resin and the restoring of the solid content.

If solvent additions are necessary, following long idle periods for example, they should be made in increments of 0.5% through the weir.

It takes about one to two hours of solution circulation before the effect becomes apparent. Its concentration is determined by appropriate chemical analysis.

pH

pH of the bath should lie between 3.5 - 4.5.

It is good practice to check the pH once a day.

It is not advised to use pH paper for pH measurements but a suitable electrode-pHmeter probe.

LACTIC ACID CONTENT

It is determined by chemical analysis in lab.

IONIC CONTAMINATION

Avoid contamination of the CERAMIX lacquer by soluble salts. They will decrease the efficiency leading to bad deposits.

Only with ultrafiltration the ionic contamination can be removed (slowly) by discarding the permeate. (Sometimes selective resins also work)

ADEQUATE CIRCULATION AND FILTRATION WILL KEEP THE LACQUER IN GOOD CONDITION.

Filter cartridge and/or bag will be clogged up with use. They should be cleaned or changed periodically.

The circulation pump should not suck air, any air getting into the circulation system will cause pitting.

It is recommended to carry out a batch filtration, followed by tank cleaning every one or two months.

DURING PROLONGED IDLE PERIODS TANK CIRCULATION CAN BE STOPPED, THE COVER OF THE TANK MUST BE CLOSED.

Alternatively the bath solution can be stored in closed containers.

RINSES (PRE- AND POST-) WITH D.I. WATER

The D.I. rinses before lacquering serve to minimize drag-in of hard water salts and pre-treatment chemicals into the CERAMIX e-coating lacquer and thereby prevent it from being contaminated.

After lacquering it can serve as a clean final rinse also.

The rinse should be dumped when the conductivity exceeds 10 $\mu\text{S}/\text{cm}$.

While doing the Post-rinse this solution gradually becomes contaminated by drag-in from the ready-to-use emulsion.

It should be replaced periodically or when the solids content reaches 1.5% by weight

ABOUT THE ULTRAFILTRATION

The use of an ultrafiltration unit has proven to be an integral part of successfully operating with this system.

Every installation should have a single tube of Ultrafiltration unit especially for volumes bigger than 150 liters. Its scope is that to minimize the effect of metallic contamination and to stabilize the pH of the solution as well as the solvent level.

ABOUT THE PROCESS WATER

Use pure D.I. water with conductivity close as much as possible to 0 $\mu\text{S}/\text{cm}$.

In any case D.I. water conductivity can not go over to 5 $\mu\text{S}/\text{cm}$ s.

ANALYTICAL PROCEDURE

1. SOLID CONTENT DETERMIANTIOJN

- Weigh a clean watch glass or aluminum foil
- Add 10 ml of working ready-to-use emulsion
- Heat it inside oven for 1 hours at 130°C
- Cool down it and re-weigh.
- Calculate the % solids content by weighing the difference.

Now consider that to increase of 1% point of solid content, it is necessary to add 15-17 g of CERAMIX-R concentrated resin per every liter of working solution

Vice versa for the "one spot" solid content determination a pocket refractometer can be used:

% solids (by weigh ratio) = 0.7 x Read °Brixel.

2. SOLVENT LEVEL DETERMINATION

It has to be run in our Technical Assistance Laboratory.

3. pH measurement

- Calibrate pHmeter
- Rinse buffered electrodes carefully in D.I. water, dry and immerse in the ready-to-use and working emulsion.
- After measuring, thoroughly rinse again electrodes in the same emulsion and finally rinse it in D.I. water again.

SUPPLEMENTARY INFORMATION

Below important supplementary information to know in order to drive this process with success.

WORKING ENVIRONMENT

It is particularly important the quality of the air and the cleanliness of the working environment. Since the e-coating layer provided by CERAMIX is sticky before the heat treatment, any air-borne particle may adhere on of the pieces causing surface defects. This problem may become particularly evident on large and flat surfaces (e.g.: medals, trays, etc.). If treated pieces are items with small surfaces (e.g.: chains) the risk for defects from airborne particles is less evident. In order to obtain the highest surface quality, it is recommended to place the equipment in a cleanroom.

OPERATING CONDITIONS - GENERAL RECOMMENDATIONS

An optimal voltage for e-coating application should be around 30 – 50 Volts. Current density is low and decreases rapidly after the first seconds of treatment, due to the insulating properties of the deposit itself. Optimal treatment time is around 15-30 seconds. In order to keep in good efficiency the e-coating liquid suspension, it is extremely important to avoid any contamination of the working suspension from the previous steps. Slight increase of salinity may negatively impair the e-coating performances, leading to clots formation.

BATH TURNOVER RATE

In order to maintain the optimum properties, the feed replenishment rate should be consistent with one bath turnover within three months.

CIRCULATION

Continuous pumped circulation from a skim weir and return via submerged pipe. Circulation turnover rate is 8-10 bath volumes per hour.

ABOUT WATER DISPOSAL AND SAFETY INFORMATION

Being acidic, prior to dispose the CERAMIX bath, increase its pH to 7-8 with alkaline solutions. The solid will precipitate out in settlement tank. Recover the supernatant liquid which will contain around 4% on volume basis of lactic acid. This liquid should be further diluted before discharge in according with the local legislation.

About its concentrate resin (CERAMIX-R) store it between 0° and 30°C. **Never store in an area where the temperature can go above 35°C.**

Smoking should be prohibited in the vicinity of the concentrate resin CERAMIX-R as well as close to the working tank emulsion.

While CERAMIX-R is flammable resin, CERAMIX will not support combustion but it is irritating to eyes and skin. In case of contact with eyes rinse immediately with plenty of D.I. water and seek medical advice if symptoms persist. After contact with skin, wash immediately with plenty of soap and water.

The solvent level normally lies around 3% in the ready-to-use emulsion.

It is strongly recommended to ensure adequate ventilation of the workroom in order to provide a healthy working atmosphere. In any case classification and designation are noted in the Material Safety Data Sheet (according to the European legislation). The safety instructions and the instructions for the environmental protection have to be followed in order to avoid hazards for people and environment. Please consider the explicit details in our Material Safety Data Sheets.

CERAMIX**NANOCERAMIC INDUSTRIAL TRANSPARENT E-COATING****DISCLAIMER**

This bulletin has to be considered as pure GENERAL GUIDELINE. Every single production process can differ in its operating and technical conditions according with the items to be covered, their shape, the used plating line and climatic condition. All recommendations and suggestions in this bulletin concerning the use of our products are based upon tests and data believed to be reliable. Since the actual use by others is beyond our control, no guarantee expressed or implied, is made by Legor Group, its subsidiaries or distributors, as to the effects of such use or results to be obtained, nor is any information to be construed as a recommendation to infringe any patent.