# *Nanoceramics*

## *New Pretreatment for 2- to 3-Zone Systems*

- For steel, aluminum, and zinc
- No sludge, no heavy metals
- Replaces iron phosphating
- Easy to handle
- Environmentally safe
- Quality similar to that of zinc phosphating

Iron phosphating is a standard method for applying a conversion coating prior to applying a subsequent layer of paint. Adhesion and corrosion resistance are better on iron-phosphated surfaces than on surfaces that have merely been washed. While zinc phosphating improves the quality still further, it does have disadvantages: it involves the use of heavy metals, it is a complicated process, and it results in excessive sludge buildup. Nanoceramics, on the other hand, can be used for generating conversion coatings on steel, aluminum, and zinc with little difficulty. The process is environmentally safe (no heavy metals), requires only one bath setting, and protects against corrosion virtually as well as zinc phosphating.

Production part after nanotreatment

Because it produces the characteristics of a coating (extremely thin, very large surface area), nanoceramic treatment yields better adhesion properties than zinc phosphating. No nanoparticles are present in either the as-received state or during processing. This eliminates any health risks posed by contamination, as the deposited layer is the only nanomaterial involved.

Above: Nanoceramic treatment
Below: Untreated steel

**System concept:**
4 – 6-zone systems with an upstream alkaline cleaning step are generally required for nanopassivation. If only a 3-zone system is available (example: degreasing/iron phosphating, rinse, DI rinse), the nanoceramic coating will be applied during

the cleaning step in a one-pot process. Conductivity values for degreasing/nanoceramics are extremely low compared to those for iron phosphating (ex.: just 500 – 700 µS instead of 5,000 – 10,000 µS). This means that the process can also be used in 2-zone systems, as the salt content in the rinse zone is only one tenth of the typical value.

1. Weakly acidic degreasing/nanoceramic treatment step with Euclean, 90 – 180 seconds, pH 4.5 – 5.4, 35 – 45°C, prepared with DI water
2. Rinse with deionized water
3. Rinse with deionized water

The degreasing/nanoceramic treatment step is followed by two rinsing steps. Deionized water is recommended, as it minimizes consumption of nanoceramic materials. Bath concentration is regulated via an automated pH adjustment unit. The cascade in the illustration shows how water is fed from the final DI (deionized) water spray ring back into the degreasing/nanoceramic coating zone as a way of reducing the use of fresh water, chemicals, energy, and wastewater. Initial colors are similar to those for iron phosphating, and range from gold to blue, gray, and shades of pale violet.

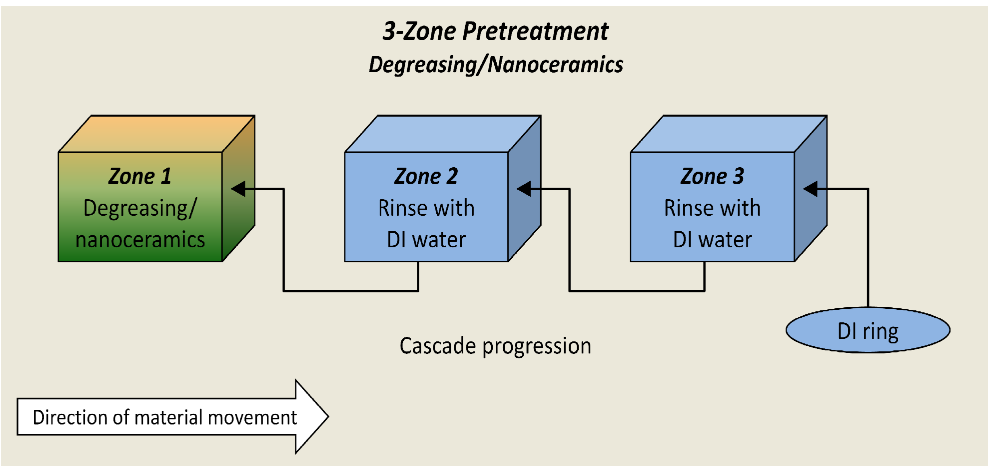
**Consumption:**

Consumption of nanoceramics is very low and does not generally exceed 2 $g/m^2$.

**Quality:**

Average corrosion creep as measured by the salt spray test (defined in DIN EN ISO 9227) was reduced to at least half of that measured for iron phosphating. Typical values after 240 hours are <1 mm for steel, 0 mm for aluminum, and 0 – 3 mm for galvanized surfaces (depending on the zinc coating). After 720 hours, values of 0 mm are generally achievable for aluminum and hot-dip galvanized metals. Values below 2 mm can be achieved for steel.

*Diagram showing a* ***3-zone system and water cascade***




Authors:

Dr. Peter Dolscheid

Martin Heinrich

DOK Chemie GmbH

Tel.: +49 (0) 23 59/29 90 50

info@dok-chemie.de