Phosphonates in oxidizing environments: From the enablement of “gentle bleaching“ to the stabilization of bulk chemicals

Expanding Chemistry Seminar - Dr. Ulrich Stoeck
COrporate history (I)

1894
Zschimmer & Schwarz was established in 1894 as a wholesale business for chemicals, dyestuffs and pharmaceuticals in Chemnitz (Saxony) by Otto Zschimmer & Max Schwarz

1909
Transformation from wholesale to large-scale production of chemical products. Production sites at Greiz-Dölau, Heinrichshall (Thuringia) and Grünberg (Bohemia) were acquired

1939
Acquisition of a production plant for tanning products at Lahnstein/Rhine. After the complete destruction of the Z&S Headquarter in Chemnitz in 1945 and the expropriation of several production sites, Zschimmer & Schwarz was rebuild in Lahnstein, which is now the headquarter of today's international group.

1993
“BACK TO THE ROOTS” - The ZSCHIMMER & SCHWARZ group acquired a research and production site in Mohsdorf near Chemnitz (Saxony).
CORPORATE HISTORY (II)

ZSCHIMMER & SCHWARZ MOHSDORF
where TRADITION meets FUTURE

- originally owned by Th. Böhme Fetchemie, a subsidiary of Henkel
- In the 1930’s: Development of the first fully synthetic detergent based on FAS (fatty alcohol sulfates)
- nearly 90 years history of manufacturing chemical products

- State-of-the-art production plant – High degree of process automatization
- ZSM is the exclusive phosphonate production site within the Z & S group
- ISO certified and continuously recertified since 1995
- Production capacity 50000 – 70000 to/annum (liquid and solid)
CUBLEN® Phosphonates
Basic Features of CUBLEN® - Phosphonates

- Chelation/Sequestration
- Threshold Effect/Hardness Stabilization
- Dispersion/Deflocculation
- Corrosion Inhibition
Stabilization of Alkaline Bleaching Baths

Blank Test

**Conditions:**
- Deionized water adjusted to pH ~ 10.5
- Temperature 65°C
- 500 ppm sequestrant (EDTMP or DTPMP)
- 2 ppm of transition metal

Iron Stabilization

Copper Stabilization

Manganese Stabilization

**Conditions:**
- Deionized water adjusted to pH ~ 10.5
- Temperature 65°C
- 500 ppm sequestrant (EDTMP or DTPMP)
- 2 ppm of transition metal
Complexing Performance in Hard Water

12°dH equals 213 mg CaCO₃ / liter
Stabilization in hard water at 20 °dH

Copper Stabilization

Iron Stabilization

Manganese Stabilization

Conditions:
- hard water (20 °dH)
  (1.19 mmol/l Mg, 2.38 mmol/l Ca)
  adjusted to pH ~ 10.5
  temperature 65°C
  500 ppm sequestrant
  2 ppm of transition metal
Stabilization of “real“ Alkaline Bleaching Baths

- **CUBLEN® phosphonates** are highly effective stabilizers of alkaline bleaching baths
- **CUBLEN® D – Series (DTPMP)** is the most versatile stabilizer under “real“ conditions
Long-Term-Stability of Gentle/Mild Bleach Detergents Formulations

Mild bleach - laundry detergent:
Phosphonate
Fatty alcohol 6,5 EO
Optical brightener
Sodium laureth sulfate 3 EO
Caustic soda
Perfume
Dye
Water
Hydrogen peroxide 50 %

Comparative Study using:
CUBLEN® K 60
CUBLEN® D 5113
CUBLEN® D 3217 N
CUBLEN® DNC 450
CUBLEN® NCD 732
DTPMP is significantly more effective than HEDP
CUBLEN® DNC 450 and NCD 732 are most effective
Stabilization of Acidic Peroxides – Enhancement of PAA Yield

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\begin{align*}
\text{H}_2\text{O}_2 & + \text{CH}_3\text{COOH} \\
\rightarrow & \\
\text{H}_2\text{O} & + \text{CH}_3\text{COO}\text{H}
\end{align*}
\]
Enhancement of Peracetic acid (PAA) Yield

- chloride content is crucial for the stabilization performance
- special CUBLEN® D grades boosts PAA Yield
Chlorine-Stable Phosphonates

ATMP - N - Oxide vs. PBTC

Chlorine Stability

Complexation

Calcium Tolerance

The Full Package - CUBLEN® ACS 402
Thank You For Your Attention!