# SALEM Advanced Surfacing Materials

| 57 La | 58 Ce | 59 Pr | 60 Nd | 61 Pm | 62 Sm | 63 Eu | 64 Gd | 65 Tb | 66 Dy | 67 Ho | 68 Er | 69 Tm | 70 Yb | 71 Lu |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lanthanide 138.91 | Cerium 140.12 | Praseodymium 138.91 | Neodymium 144.24 | Promethium (145) | Samarium 150.35 | Europium 151.96 | Gadolinium 157.25 | Terbium 158.924 | Dysprosium 162.50 | Holmium 164.930 | Erbium 167.26 | Thulium 168.934 | Ytterbium 173.04 | Lutetium 174.97 |

# 58 Ce

Cerium
140.12

## Specific Gravity - Baumé

| Specific Gravity | Baumé |
|---|---|
| 1.005 | 0.72 |
| 1.010 | 1.44 |
| 1.015 | 2.14 |
| 1.020 | 2.84 |
| 1.025 | 3.54 |
| 1.030 | 4.22 |
| 1.035 | 4.90 |
| 1.040 | 5.58 |
| 1.045 | 6.24 |
| 1.050 | 6.91 |
| 1.055 | 7.56 |
| 1.060 | 8.21 |
| 1.065 | 8.85 |
| 1.070 | 9.49 |
| 1.075 | 10.12 |
| 1.080 | 10.74 |
| 1.085 | 11.36 |
| 1.090 | 11.97 |
| 1.095 | 12.58 |
| 1.100 | 13.18 |

*Degrees Baumé (U.S. Standard) corresponding to specific gravities at 60°/60°F – 15.56°/15.56°C for liquids heavier than water.*

*Calculated: °Bé = 145 - 145/specific gravity*

## Selection

Polishing performance is dependent upon the chemical properties of the specific type of glass being polished. Glass materials vary in degree of reactivity to cerium oxide polishing slurries. Manufacturers engineer polishes to be more chemically or mechanically active to optimize polishing performance on a particular glass. For example, BK7 is a relatively hard optical glass (Knoop 520) and reacts readily to the chemical process of polishing. The polish used would be one that was processed to be more chemically reactive. On the other hand, Crown optical glass is not as hard (Knoop 450) but is more chemically durable. In this case, the polish used would be one that had been thermally treated to increase particle hardness to maximize the mechanical characteristics.

## Preparation

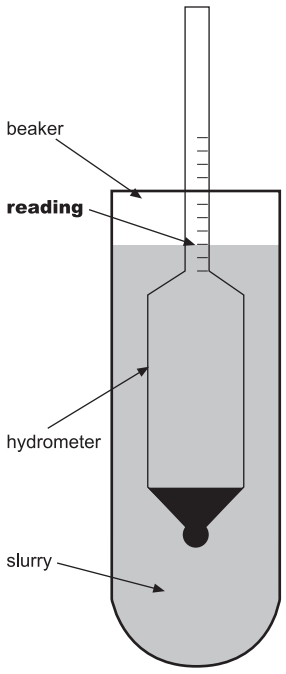
Optimum results can only be achieved by careful slurry preparation and maintenance. The following is a proven method that will ensure consistent and dependable cerium oxide polishing - job after job.

- Measure 3/4 of the water required for a charge. Only use water between 90 - 95°F. Ordinary tap water can be used, but in some areas and applications optimum results are obtained by using treated water.
- While stirring the water, vigorously sprinkle the cerium oxide compound into the water. To minimize agglomeration of the particles, avoid adding the compound too quickly. This will ensure maximum suspension and complete “wetting."
- Continue to stir the slurry for approximately 5 minutes after all the compound has been added. The stirring time will vary from application to application depending upon the type of cerium oxide compound being used and the target concentration (Baumé).
- Allow the slurry to set for several hours or overnight to allow for optimum wetting.
- Before adding the prepared slurry into the machine, re-stir vigorously and add the remaining water to achieve the required Baumé. Verify the Baumé and make adjustments if necessary.

*continued on next page*

| Baumé | Ounces of Cerium Per Gallons of Water |
|---|---|
| 1 | 1.6 |
| 2 | 2.4 |
| 3 | 4.0 |
| 4 | 5.6 |
| 5 | 7.2 |
| 6 | 8.0 |
| 7 | 9.6 |
| 8 | 11.2 |
| 9 | 12.8 |
| 10 | 14.4 |
| 11 | 15.2 |
| 12 | 17.6 |

*This chart reflects typical relationships. Actual amounts will vary depending upon the polish used.*



| 57 | 58 | 59 | 60 | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| La | Ce | Pr | Nd | Pm | Sm | Eu | Gd | Tb | Dy | Ho | Er | Tm | Yb | Lu |
| Lanthanide 138.91 | Cerium 140.12 | Praseodymium 138.91 | Neodymium 144.24 | Promethium (145) | Samarium 150.35 | Europium 151.96 | Gadolinium 157.25 | Terbium 158.924 | Dysprosium 162.50 | Holmium 164.930 | Erbium 167.26 | Thulium 168.934 | Ytterbium 173.04 | Lutetium 174.97 |

- Monitor the Baumé every 2 hours during the polishing cycle and make adjustments accordingly.

- Check the temperature of the slurry regularly. In most applications, optimum results are obtained with slurry temperatures between 86-95°F.

- Check the pH of the slurry when used over a prolonged period. Optimum polishing speeds and finishes are obtained when the pH is between 7.0 and 9.0.

**Concentration**

When recharging the system always thoroughly clean the slurry tanks. Maintaining the proper cerium concentration (solids to liquid ratio) is vital to efficient glass polishing. Studies show that companies not systematically monitoring cerium concentrations are using up to 50% too much cerium oxide. Using more cerium than the optimum amount does not increase polishing performance, but only adds to production costs. Too much cerium oxide will cause the polishing pad to load and glaze, dramatically reducing polishing effectiveness. Optimizing the slurry concentration reduces “carry-out,” resulting in lower cerium consumption while yielding a cleaner glass surface.

*float hydrometer*

- Determine the target concentration. This will vary depending upon application, type of cerium, etc.

- Schedule routine checks of the slurry throughout a shift and make necessary adjustments to maintain the slurry at the optimum concentration.

- The concentration of cerium oxide in a polishing slurry is normally measured with a float hydrometer, reading in degrees Baumé.

- A sample of slurry is poured into a beaker.

- The hydrometer is then gently lowered into the liquid until it floats freely.

- The point where the surface of the liquid touches the graduated scale of the hydrometer is noted and then accurate adjustments to the slurry can be made.

| pH Value | number of times more acid or alkaline than pure water |
|---|---|
| acid | |
| 0 | 10,000,000 |
| 1 | 1,000,000 |
| 2 | 100,000 |
| 3 | 10,000 |
| 4 | 1,000 |
| 5 | 100 |
| 6 | 10 |
| 7 | 1 |
| 8 | 10 |
| 9 | 100 |
| 10 | 1,000 |
| 11 | 10,000 |
| 12 | 100,000 |
| 13 | 1,000,000 |
| 14 | 10,000,000 |
| alkaline | |

**pH**

pH is a measurement of the hydrogen ion concentration of a solution, or the acidity of the solution. Alkalinity depends upon the concentration of hydroxyl ions and could be expressed in a similar pOH scale. However, since the sum of hydrogen ions and hydroxyl ions is constant in a water solution, two scales are not necessary, and pH values are used to express alkalinity as well as acidity. In order to convey some idea of the degree of acidity relating to various pH values, a solution with a pH of 5.0 is ten times as acidic as a solution with a pH of 6.0; a solution with a pH of 4.0 is ten times as acidic as one with the pH of 5.0. Thus a pH of 4.0 indicates an acidity one hundred times greater than a pH of 6.0. Similar relationships also hold true on the alkaline side of the scale. This relationship is represented by the chart.

- Stock removal rates can be affected by pH. It is important to know the optimum pH and control it.

- Some polishing compounds lose their suspension properties and settle hard when the proper pH is not maintained.

- Some types of glass may be etched when the proper pH level is not maintained.

- Glass is alkaline. During the polishing cycle, surface residues from the glass leach into the polishing slurry, gradually increasing the alkalinity of the polish.

- A too high or too low pH may cause operator discomfort.