

# Heart of Glass- $\Delta 6$

Lab 3-Sili-Closeness

# Heart of Glass

Original  
070922-1

|                  |       |
|------------------|-------|
| Neph Sy          | 39.82 |
| Whiting          | 14.16 |
| Zinc Oxide       | 12.39 |
| EPK              | 8.94  |
| Flint            | 22.71 |
| Bentonite        | 1.98  |
| Copper Carbonate | 0.99  |
| Water            | 75    |



1-3 Second Dip



2-3 Second Dips

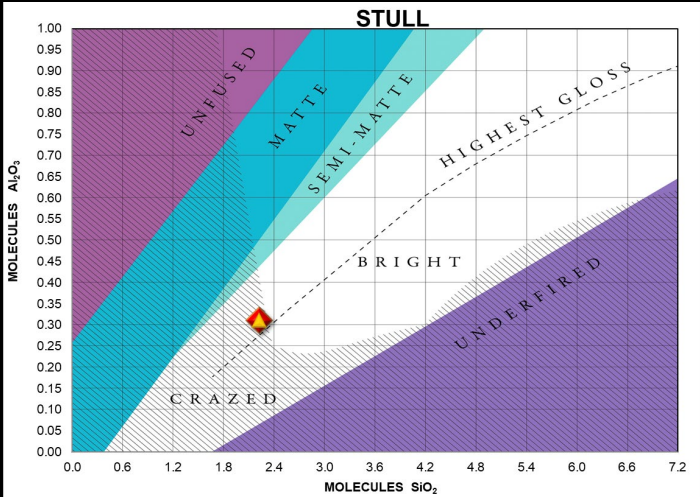


Reduction



UMF

| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>7.14 : 1 |                                                      | Alkali Metals<br>0.22          |                          | Alkaline Earths<br>0.78 |             |
|--------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|-------------------------|-------------|
| SiO <sub>2</sub><br>2.27                                           | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.32 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00             | CaO<br>0.37 |
| B <sub>2</sub> O <sub>3</sub>                                      | Al <sub>2</sub> O <sub>3</sub><br>0.32               | Li <sub>2</sub> O              | CuO                      | SrO                     | BaO         |
| TiO <sub>2</sub><br>0.00                                           | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.39             | FeO<br>0.01 |
| Cr <sub>2</sub> O <sub>3</sub>                                     | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO <sub>2</sub>        | CoO         |



EUMF

| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>7.14 : 1 |                                                      | Alkali Metals<br>0.24          |                          | Alkaline Earths<br>0.76 |             |
|--------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|-------------------------|-------------|
| SiO <sub>2</sub><br>2.23                                           | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.31 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00             | CaO<br>0.37 |
| B <sub>2</sub> O <sub>3</sub>                                      | Al <sub>2</sub> O <sub>3</sub><br>0.31               | Li <sub>2</sub> O              | CuO<br>0.02              | SrO                     | BaO         |
| TiO <sub>2</sub><br>0.00                                           | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.39             | FeO<br>0.00 |
| Cr <sub>2</sub> O <sub>3</sub>                                     | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO <sub>2</sub>        | CoO         |

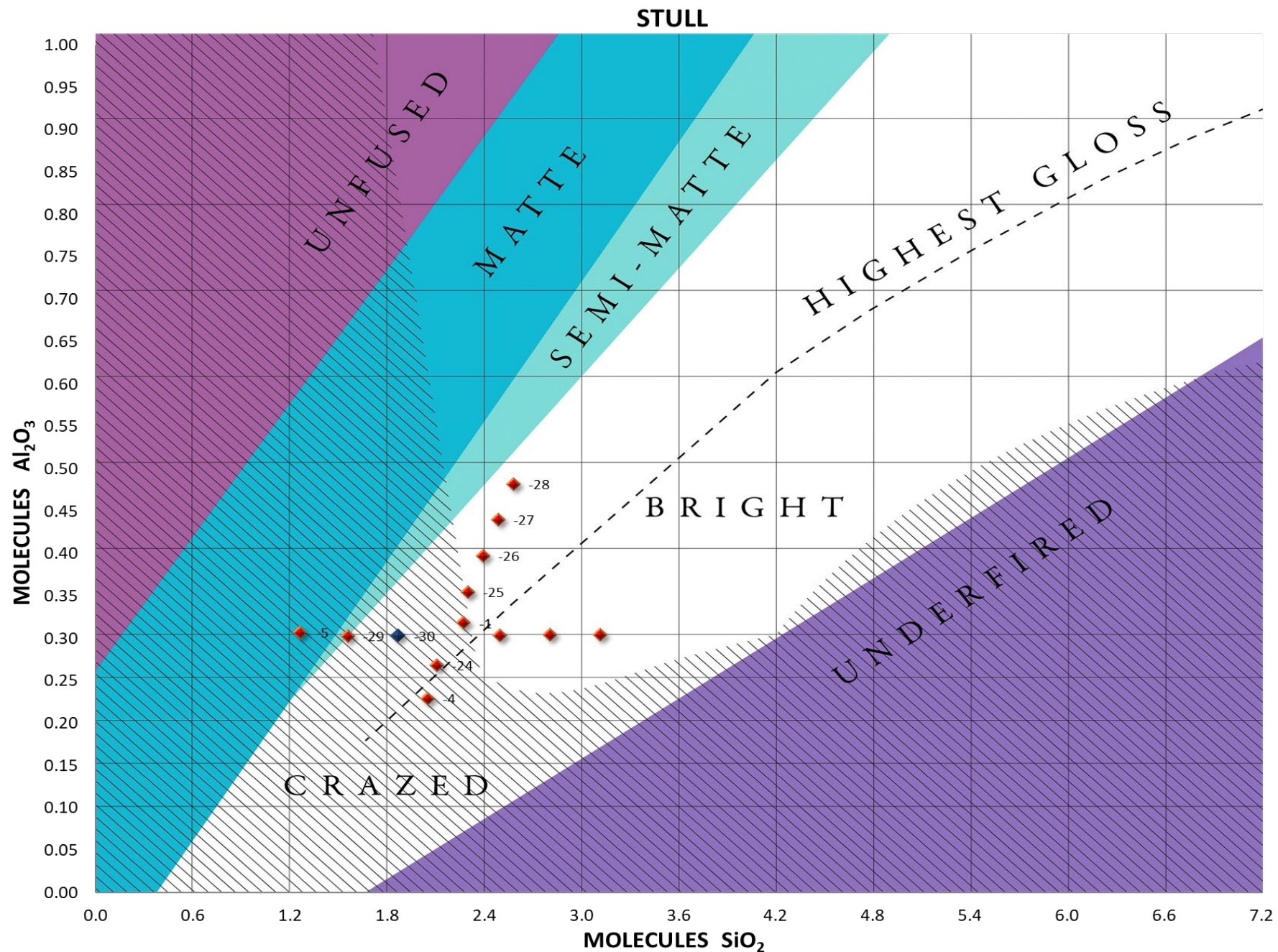


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Materials  
Workshop

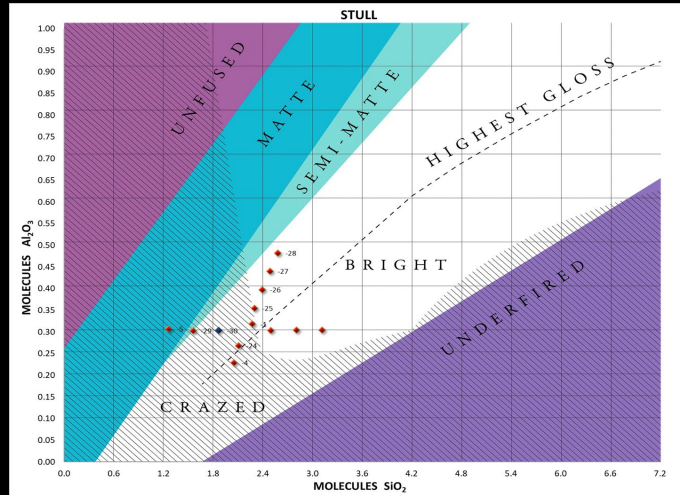
# UMF



Ceramic  
Materials  
Workshop



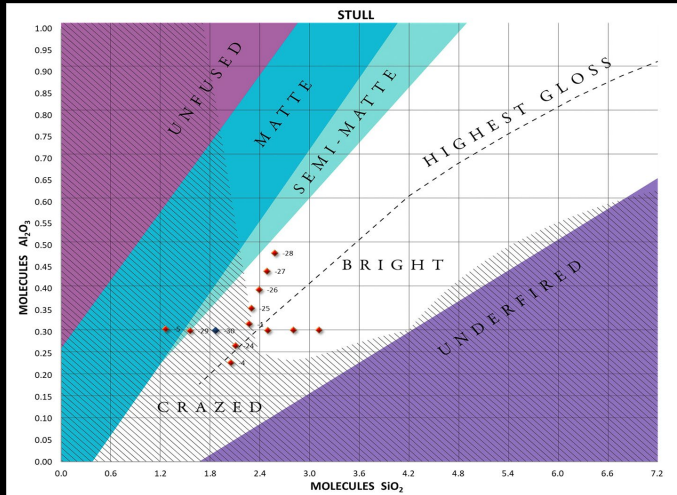
# Full Test-Oxidation-1-3 Second Dip



Indicates correct position of Alumina samples



# Full Test-Oxidation-2-3 Second Dips



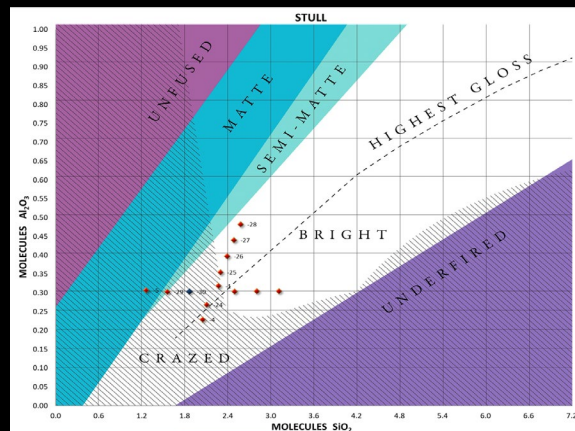
Indicates correct position of Alumina samples



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# Silica Variations-Oxidation



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# Alumina Variations-Oxidation



070922-4



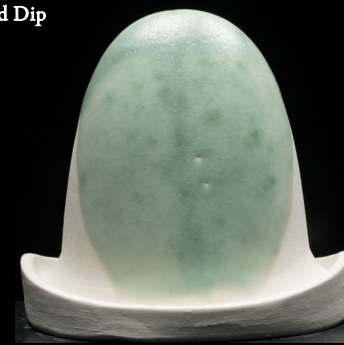
070922-24



070922-1



070922-25



070922-26



070922-27

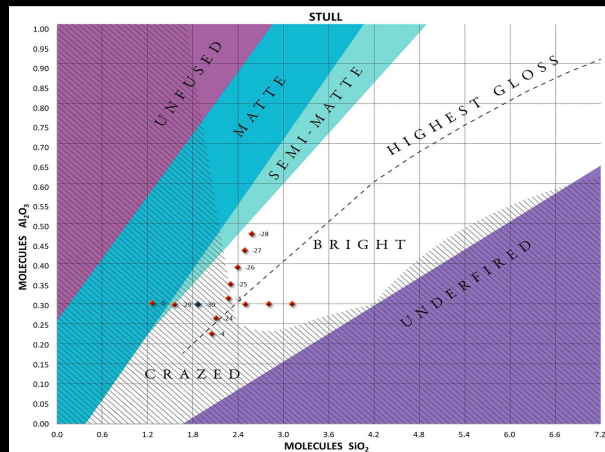


070922-28

1-3 Second Dip



2-3 Second Dips

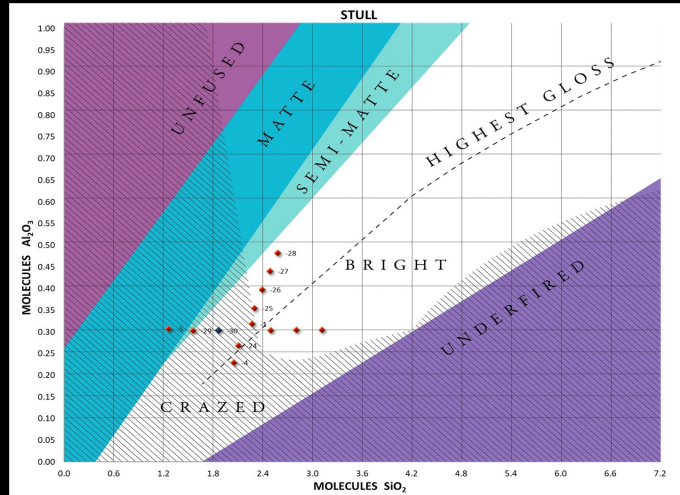


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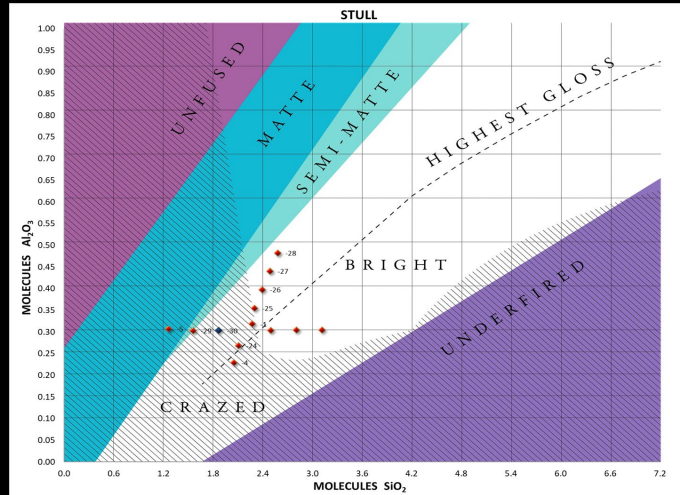
# Full Test-Reduction-1-3 Second Dip



Indicates correct position of Alumina samples



# Full Test-Reduction-2-3 Second Dips



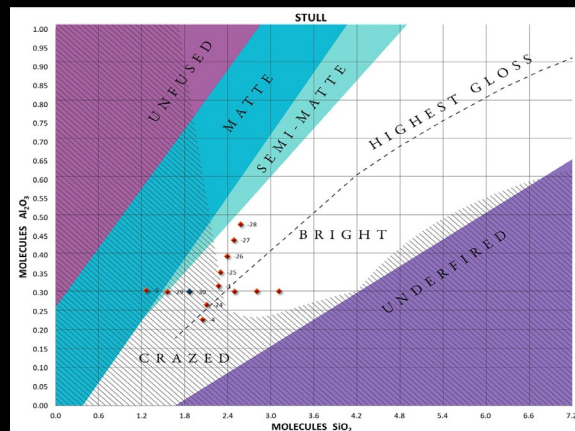
Indicates correct position of Alumina samples



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# Silica Variations-Reduction



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# Alumina Variations-Reduction



070922-4



070922-24



070922-1



070922-25



070922-26

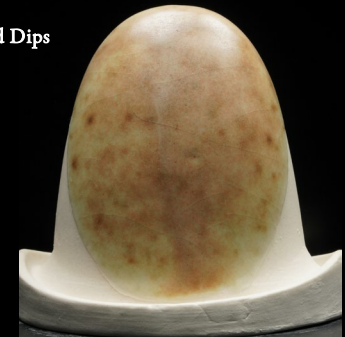


070922-27

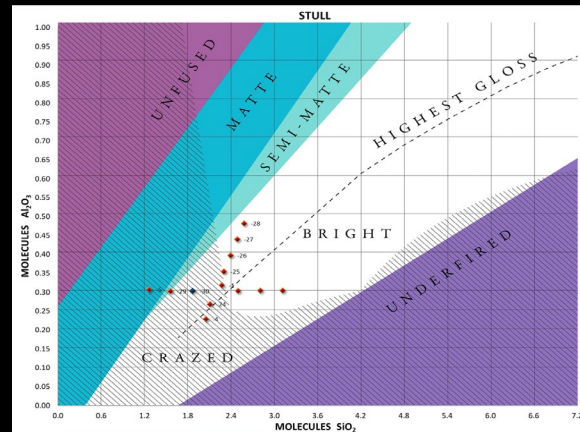


070922-28

1-3 Second Dip



2-3 Second Dips



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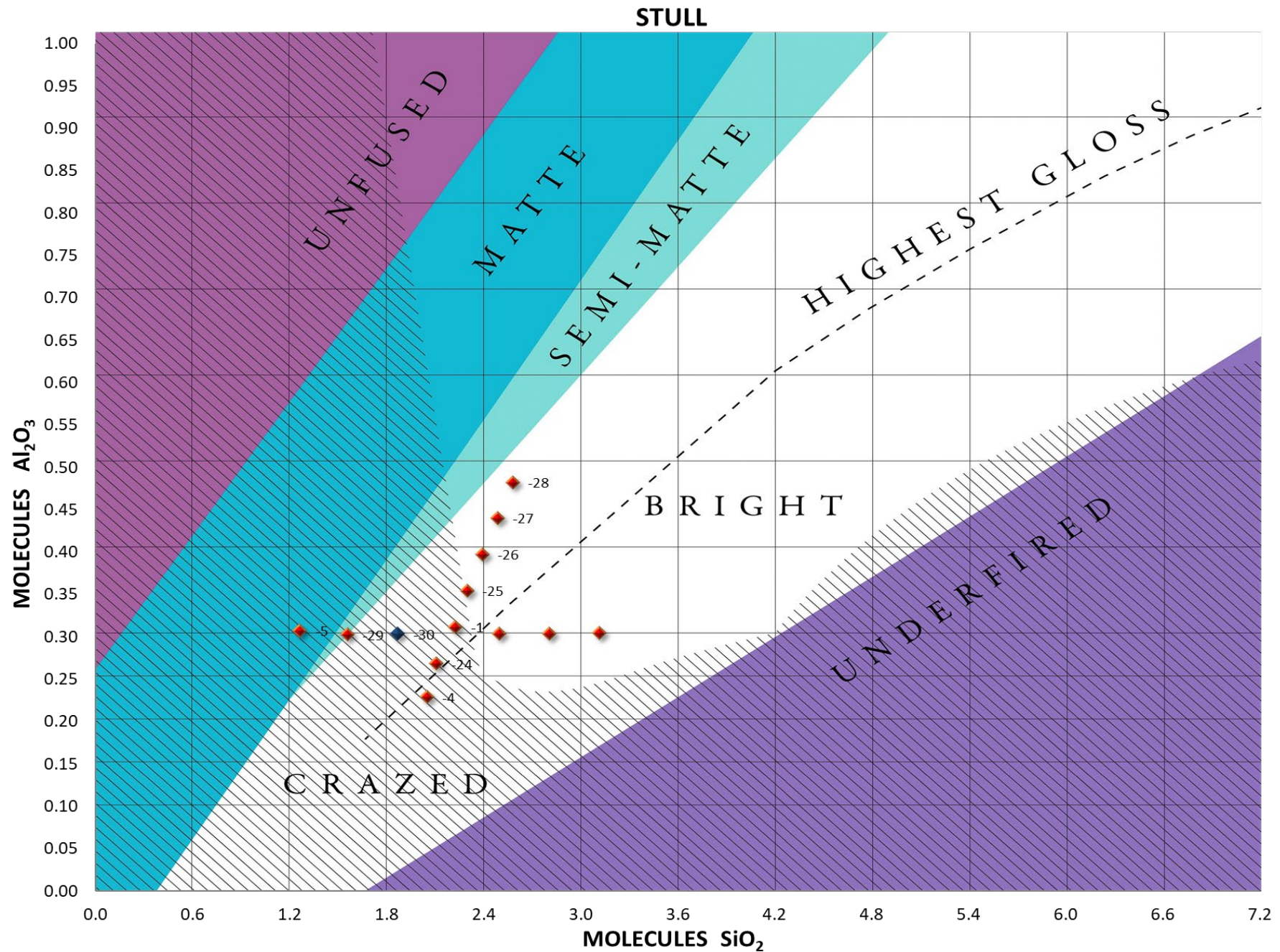


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# EUMF



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# Heart of Glass

Original  
070922-1

|                  |       |
|------------------|-------|
| Neph Sy          | 39.82 |
| Whiting          | 14.16 |
| Zinc Oxide       | 12.39 |
| EPK              | 8.94  |
| Flint            | 22.71 |
| Bentonite        | 1.98  |
| Copper Carbonate | 0.99  |
| Water            | 75    |



1-3 Second Dip



2-3 Second Dips

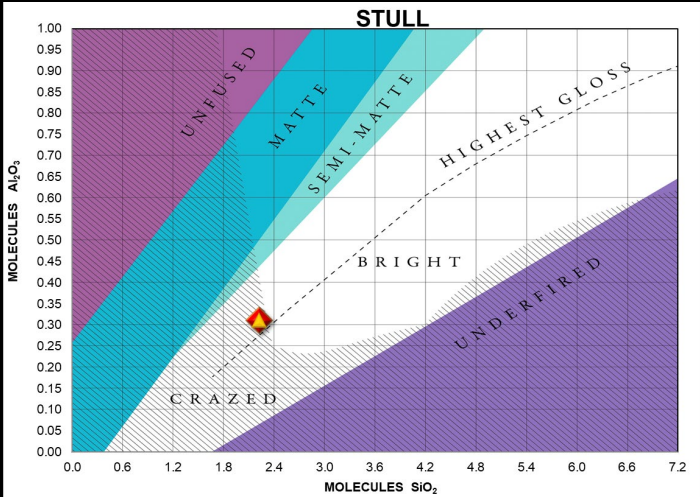


Reduction



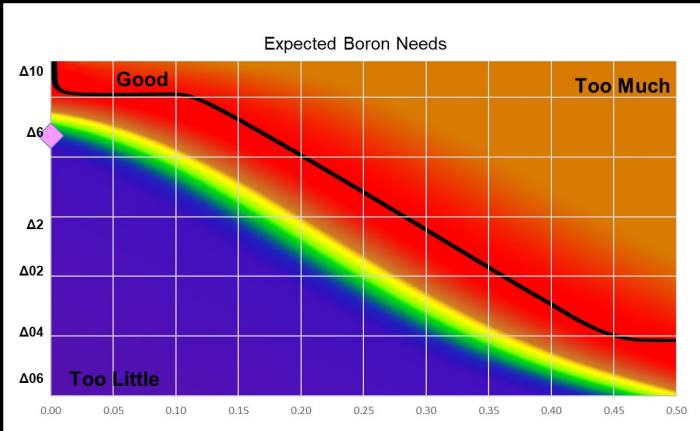
UMF

| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>7.14 : 1 |                                                      | Alkali Metals<br>0.22          |                          | Alkaline Earths<br>0.78 |             |
|--------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|-------------------------|-------------|
| SiO <sub>2</sub><br>2.27                                           | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.32 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00             | CaO<br>0.37 |
| B <sub>2</sub> O <sub>3</sub>                                      | Al <sub>2</sub> O <sub>3</sub><br>0.32               | Li <sub>2</sub> O              | CuO                      | SrO                     | BaO         |
| TiO <sub>2</sub><br>0.00                                           | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.39             | FeO<br>0.01 |
| Cr <sub>2</sub> O <sub>3</sub>                                     | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO <sub>2</sub>        | CoO         |



EUMF

| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>7.14 : 1 |                                                      | Alkali Metals<br>0.24          |                          | Alkaline Earths<br>0.76 |             |
|--------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|-------------------------|-------------|
| SiO <sub>2</sub><br>2.23                                           | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.31 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00             | CaO<br>0.37 |
| B <sub>2</sub> O <sub>3</sub>                                      | Al <sub>2</sub> O <sub>3</sub><br>0.31               | Li <sub>2</sub> O              | CuO<br>0.02              | SrO                     | BaO         |
| TiO <sub>2</sub><br>0.00                                           | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.39             | FeO<br>0.00 |
| Cr <sub>2</sub> O <sub>3</sub>                                     | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO <sub>2</sub>        | CoO         |



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# Heart of Glass

w/o Kaolin

070922-4

|                  |       |
|------------------|-------|
| Neph Sy          | 44.70 |
| Whiting          | 15.89 |
| Zinc Oxide       | 13.91 |
| EPK              |       |
| Flint            | 25.49 |
| Copper Carbonate | 1.01  |
| Water            | 60    |



1-3 Second Dip

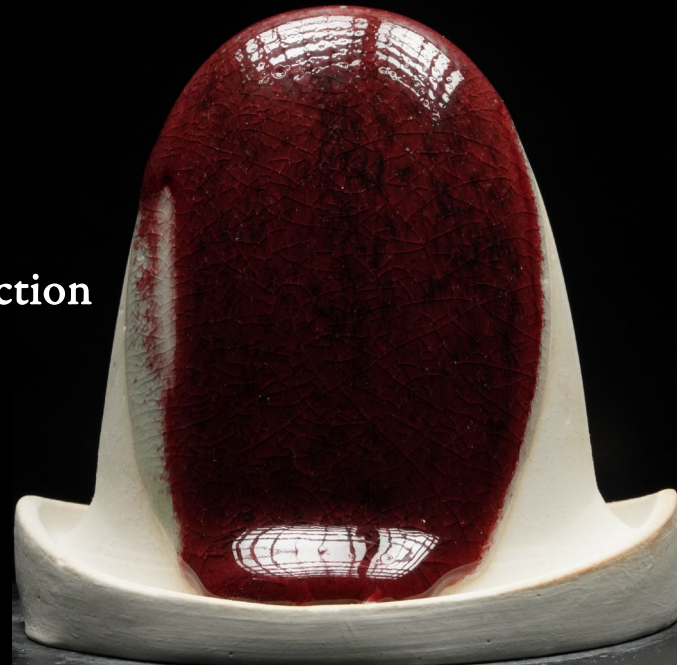


2-3 Second Dips

Oxidation



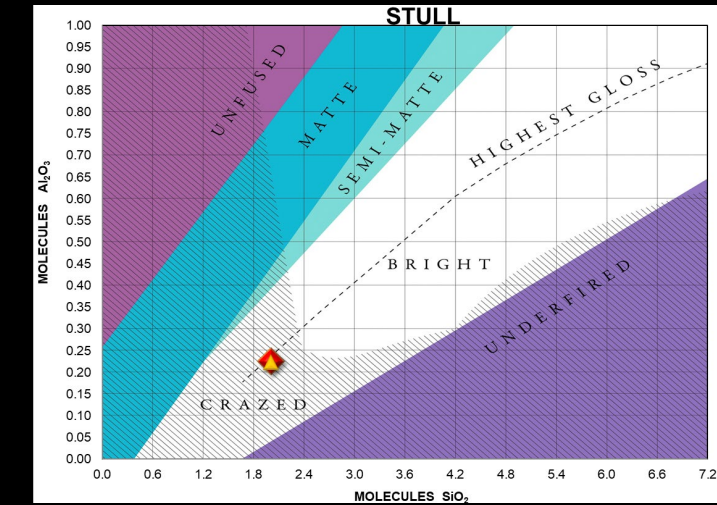
Reduction



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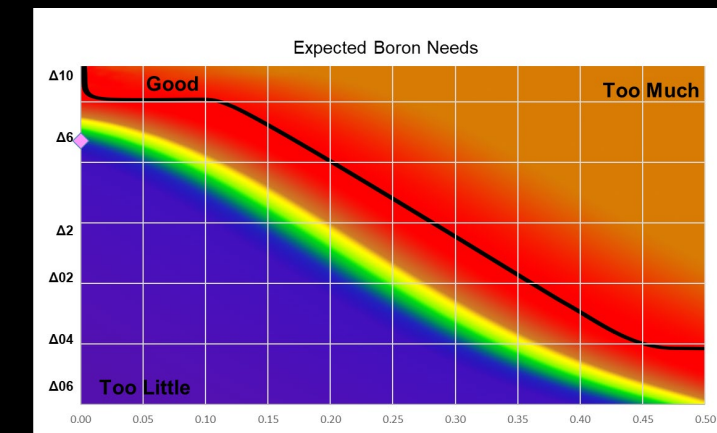
UMF

| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>8.95 : 1 |                                                      | Alkali Metals<br>0.22          |                          | Alkaline Earths<br>0.78 |             |
|--------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|-------------------------|-------------|
| SiO <sub>2</sub><br>2.05                                           | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.23 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00             | CaO<br>0.38 |
| B <sub>2</sub> O <sub>3</sub>                                      | Al <sub>2</sub> O <sub>3</sub><br>0.23               | Li <sub>2</sub> O              | CuO                      | SrO                     | BaO         |
| TiO <sub>2</sub><br>0.00                                           | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.40             | FeO<br>0.00 |
| Cr <sub>2</sub> O <sub>3</sub>                                     | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO <sub>2</sub>        | CoO         |



EUMF

| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>8.95 : 1 |                                                      | Alkali Metals<br>0.24          |                          | Alkaline Earths<br>0.76 |             |
|--------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|-------------------------|-------------|
| SiO <sub>2</sub><br>2.01                                           | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.22 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00             | CaO<br>0.37 |
| B <sub>2</sub> O <sub>3</sub>                                      | Al <sub>2</sub> O <sub>3</sub><br>0.22               | Li <sub>2</sub> O              | CuO<br>0.02              | SrO                     | BaO         |
| TiO <sub>2</sub><br>0.00                                           | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.39             | FeO<br>0.00 |
| Cr <sub>2</sub> O <sub>3</sub>                                     | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO <sub>2</sub>        | CoO         |

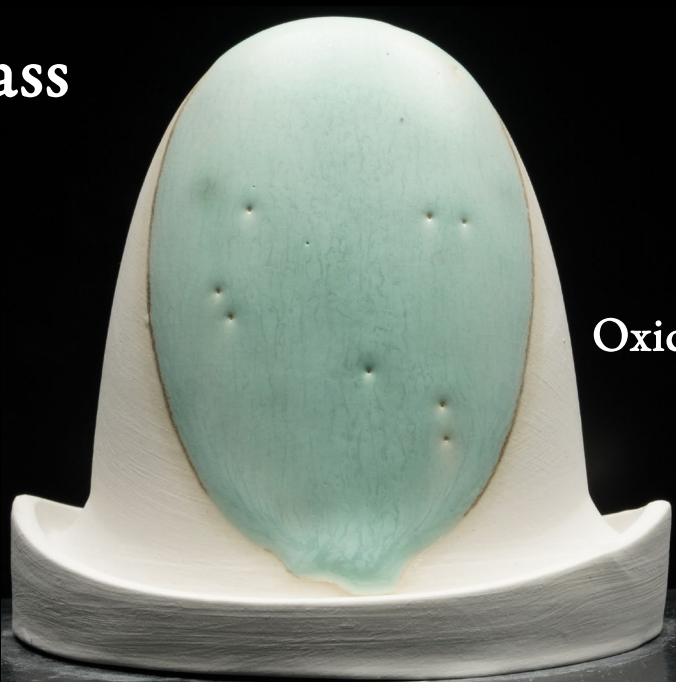


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# Heart of Glass

w/o Silica  
070922-5

|                  |       |
|------------------|-------|
| Neph Sy          | 52.88 |
| Whiting          | 18.80 |
| Zinc Oxide       | 16.45 |
| EPK              | 11.87 |
| Flint            |       |
| Copper Carbonate | 1.01  |
| Water            | 70    |



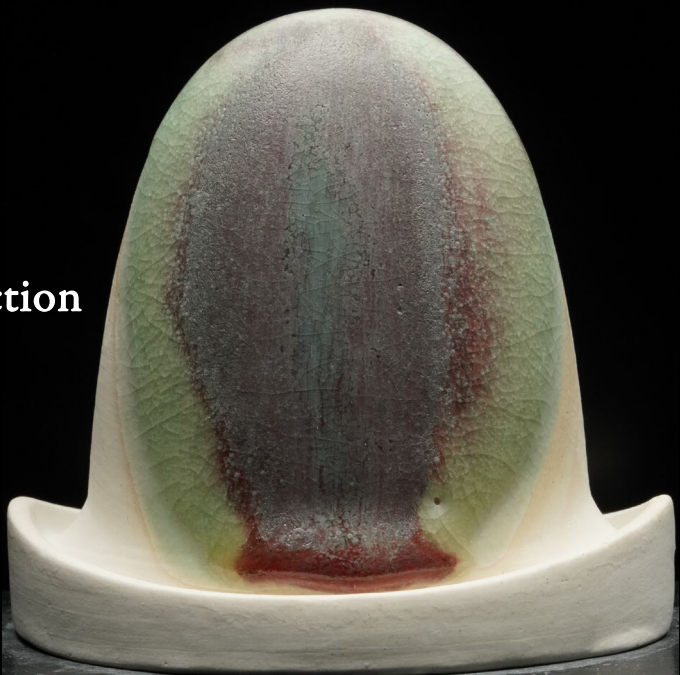
1-3 Second Dip



2-3 Second Dips



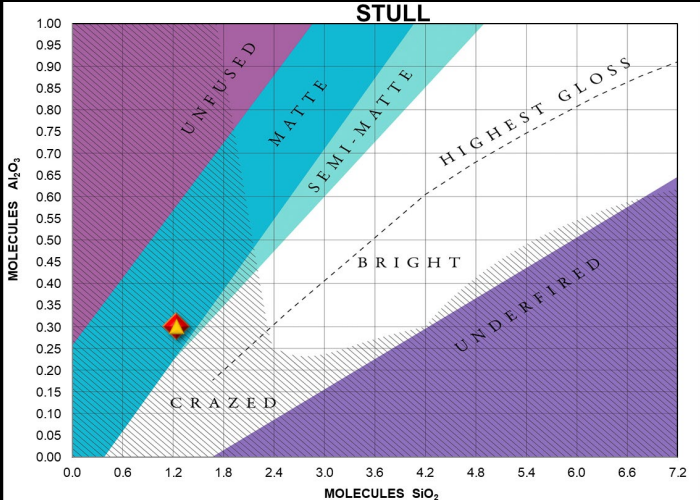
Reduction



Oxidation

UMF

| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>4.11 : 1 |                                                      | Alkali Metals<br>0.22          |                          | Alkaline Earths<br>0.78 |             |
|--------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|-------------------------|-------------|
| SiO <sub>2</sub><br>1.26                                           | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.31 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00             | CaO<br>0.38 |
| B <sub>2</sub> O <sub>3</sub>                                      | Al <sub>2</sub> O <sub>3</sub><br>0.31               | Li <sub>2</sub> O              | CuO                      | SrO                     | BaO         |
| TiO <sub>2</sub><br>0.00                                           | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.40             | FeO<br>0.00 |
| Cr <sub>2</sub> O <sub>3</sub>                                     | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO <sub>2</sub>        | CoO         |



EUMF

| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>4.11 : 1 |                                                      | Alkali Metals<br>0.23          |                          | Alkaline Earths<br>0.77 |             |
|--------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|-------------------------|-------------|
| SiO <sub>2</sub><br>1.24                                           | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.30 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00             | CaO<br>0.37 |
| B <sub>2</sub> O <sub>3</sub>                                      | Al <sub>2</sub> O <sub>3</sub><br>0.30               | Li <sub>2</sub> O              | CuO<br>0.02              | SrO                     | BaO         |
| TiO <sub>2</sub><br>0.00                                           | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.39             | FeO<br>0.00 |
| Cr <sub>2</sub> O <sub>3</sub>                                     | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO <sub>2</sub>        | CoO         |



Ceramic  
Materials  
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# Heart of Glass

Mapping  
Kaolin 2  
070822-24

|                  |       |
|------------------|-------|
| Neph Sy          | 42.35 |
| Whiting          | 15.06 |
| Zinc Oxide       | 13.18 |
| EPK              | 5.26  |
| Flint            | 24.15 |
| Copper Carbonate | 1.01  |
| Water            | 70    |



Oxidation

1-3 Second Dip



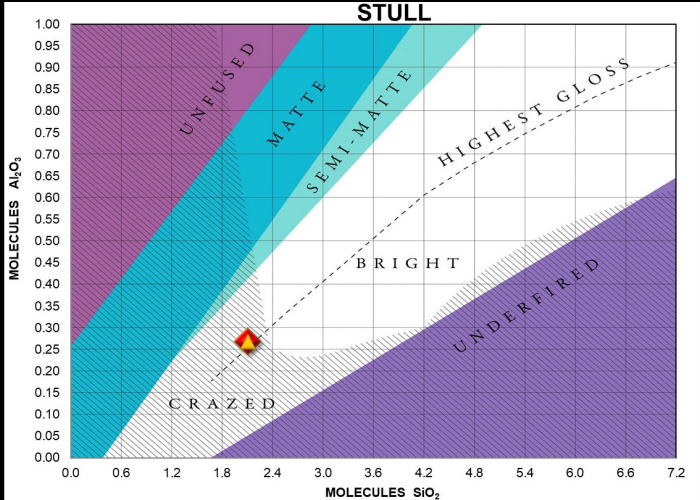
2-3 Second Dips



Reduction



| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>7.85 : 1 |                                                      | Alkali Metals<br>0.22          |                          | Alkaline Earths<br>0.78 |             |
|--------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|-------------------------|-------------|
| SiO <sub>2</sub><br>2.15                                           | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.27 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00             | CaO<br>0.38 |
| B <sub>2</sub> O <sub>3</sub>                                      | Al <sub>2</sub> O <sub>3</sub><br>0.27               | Li <sub>2</sub> O              | CuO                      | SrO                     | BaO         |
| TiO <sub>2</sub><br>0.00                                           | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.40             | FeO<br>0.00 |
| Cr <sub>2</sub> O <sub>3</sub>                                     | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO <sub>2</sub>        | CoO         |



| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>7.85 : 1 |                                                      | Alkali Metals<br>0.24          |                          | Alkaline Earths<br>0.76 |             |
|--------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|-------------------------|-------------|
| SiO <sub>2</sub><br>2.11                                           | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.27 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00             | CaO<br>0.37 |
| B <sub>2</sub> O <sub>3</sub>                                      | Al <sub>2</sub> O <sub>3</sub><br>0.27               | Li <sub>2</sub> O              | CuO<br>0.02              | SrO                     | BaO         |
| TiO <sub>2</sub><br>0.00                                           | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.39             | FeO<br>0.00 |
| Cr <sub>2</sub> O <sub>3</sub>                                     | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO <sub>2</sub>        | CoO         |

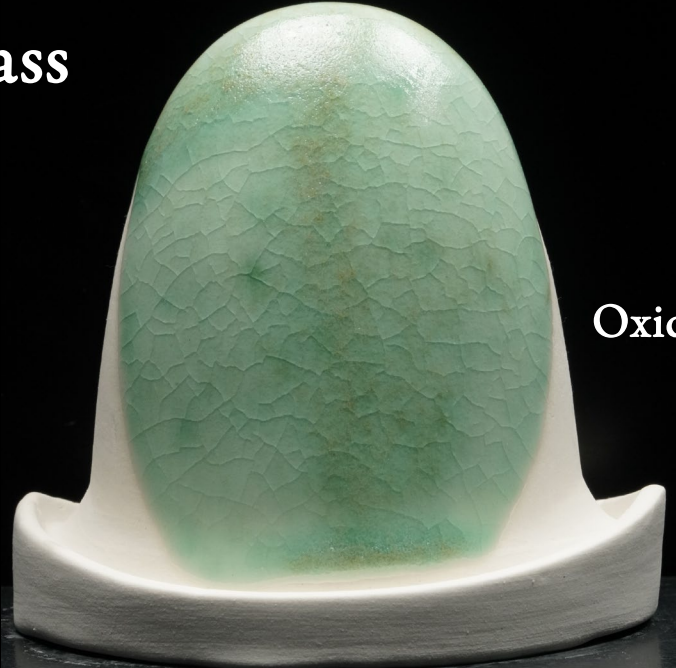


Ceramic  
Materials  
Workshop

# Heart of Glass

Mapping  
Kaolin 3  
070822-25

|                  |       |
|------------------|-------|
| Neph Sy          | 38.05 |
| Whiting          | 13.53 |
| Zinc Oxide       | 11.84 |
| EPK              | 14.19 |
| Flint            | 21.70 |
| Copper Carbonate | 1.00  |
| Water            | 70    |



1-3 Second Dip



2-3 Second Dips



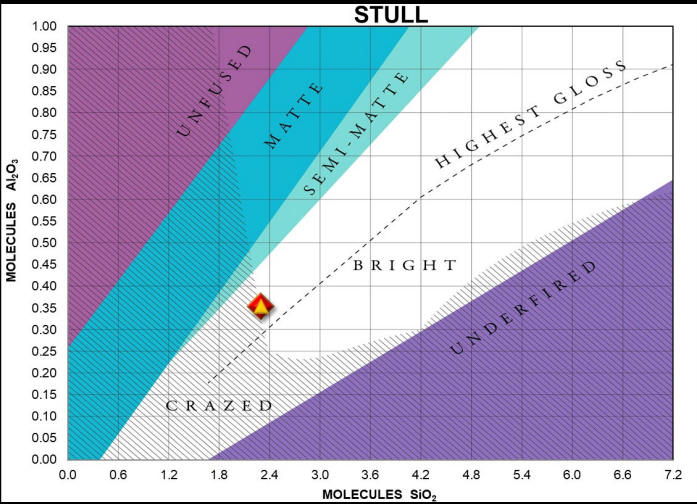
Reduction



Oxidation

UMF

| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>6.48 : 1 |                                                      | Alkali Metals<br>0.22          |                          | Alkaline Earths<br>0.78 |             |
|--------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|-------------------------|-------------|
| SiO <sub>2</sub><br>2.35                                           | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.36 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00             | CaO<br>0.37 |
| B <sub>2</sub> O <sub>3</sub>                                      | Al <sub>2</sub> O <sub>3</sub><br>0.36               | Li <sub>2</sub> O              | CuO                      | SrO                     | BaO         |
| TiO <sub>2</sub><br>0.00                                           | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.40             | FeO<br>0.01 |
| Cr <sub>2</sub> O <sub>3</sub>                                     | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO <sub>2</sub>        | CoO         |



EUMF

| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>6.48 : 1 |                                                      | Alkali Metals<br>0.24          |                          | Alkaline Earths<br>0.76 |             |
|--------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|-------------------------|-------------|
| SiO <sub>2</sub><br>2.30                                           | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.35 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00             | CaO<br>0.37 |
| B <sub>2</sub> O <sub>3</sub>                                      | Al <sub>2</sub> O <sub>3</sub><br>0.35               | Li <sub>2</sub> O              | CuO<br>0.02              | SrO                     | BaO         |
| TiO <sub>2</sub><br>0.00                                           | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.39             | FeO<br>0.01 |
| Cr <sub>2</sub> O <sub>3</sub>                                     | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO                     | CoO         |

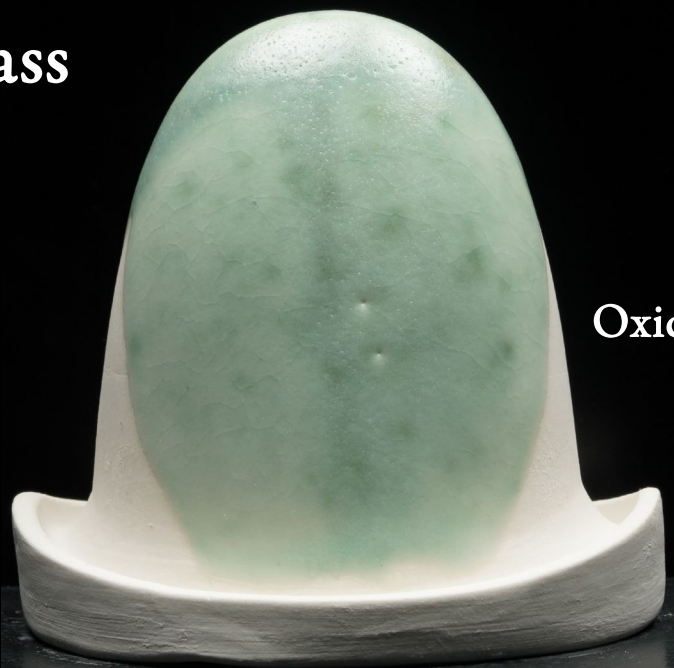


Ceramic  
Materials  
Workshop

# Heart of Glass

Mapping  
Kaolin 3  
070822-26

|                  |       |
|------------------|-------|
| Neph Sy          | 36.58 |
| Whiting          | 13.01 |
| Zinc Oxide       | 11.38 |
| EPK              | 18.18 |
| Flint            | 20.86 |
| Copper Carbonate | 1.01  |
| Water            | 80    |



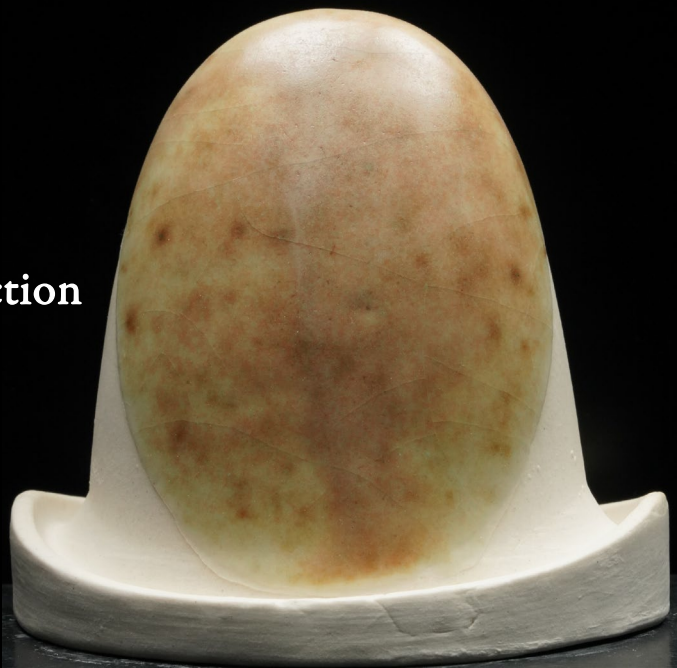
1-3 Second Dip



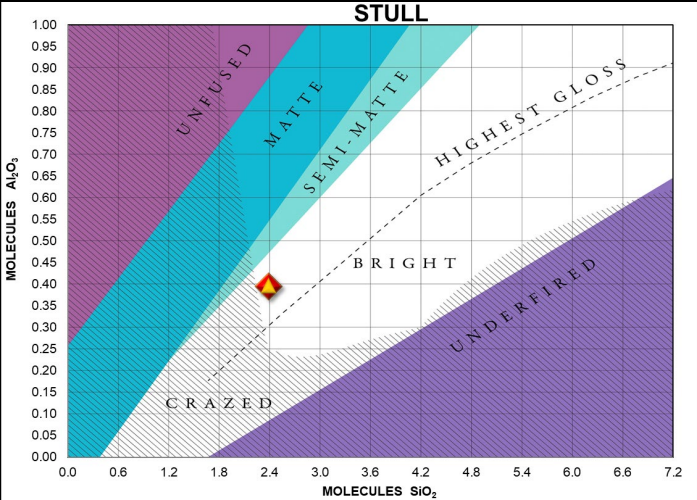
2-3 Second Dips



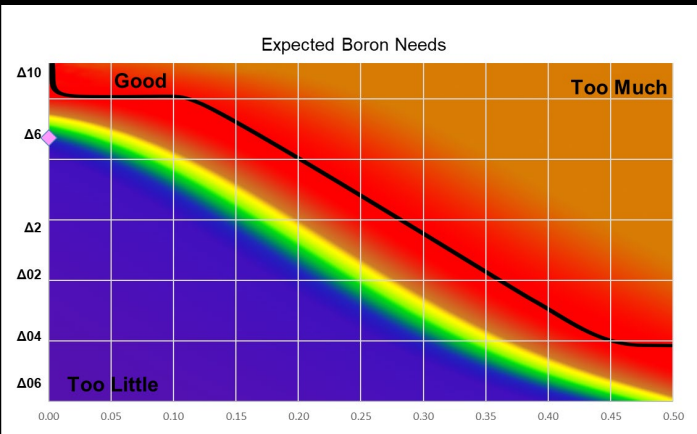
Reduction



| UMF                                                                |                                                      | Alkali Metals                  |                          | Alkaline Earths  |             |
|--------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|------------------|-------------|
| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>6.02 : 1 |                                                      | 0.22                           |                          | 0.78             |             |
| SiO <sub>2</sub><br>2.45                                           | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.41 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00      | CaO<br>0.37 |
| B <sub>2</sub> O <sub>3</sub>                                      | Al <sub>2</sub> O <sub>3</sub><br>0.40               | Li <sub>2</sub> O              | CuO                      | SrO              | BaO         |
| TiO <sub>2</sub><br>0.00                                           | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.39      | FeO<br>0.01 |
| Cr <sub>2</sub> O <sub>3</sub>                                     | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO <sub>2</sub> | CoO         |



| EUMF                                                               |                                                      | Alkali Metals                  |                          | Alkaline Earths  |             |
|--------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|------------------|-------------|
| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>6.02 : 1 |                                                      | 0.24                           |                          | 0.76             |             |
| SiO <sub>2</sub><br>2.39                                           | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.40 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00      | CaO<br>0.36 |
| B <sub>2</sub> O <sub>3</sub>                                      | Al <sub>2</sub> O <sub>3</sub><br>0.39               | Li <sub>2</sub> O              | CuO<br>0.02              | SrO              | BaO         |
| TiO <sub>2</sub><br>0.00                                           | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.39      | FeO<br>0.01 |
| Cr <sub>2</sub> O <sub>3</sub>                                     | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO <sub>2</sub> | CoO         |

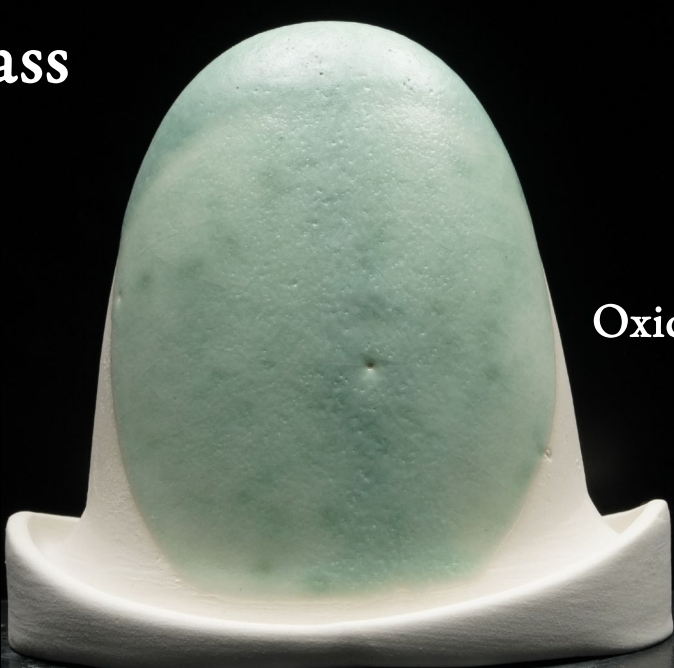


Ceramic  
Materials  
Workshop

# Heart of Glass

Mapping  
Kaolin 4  
070822-27

|                  |       |
|------------------|-------|
| Neph Sy          | 34.99 |
| Whiting          | 12.44 |
| Zinc Oxide       | 10.89 |
| EPK              | 21.74 |
| Flint            | 19.95 |
| Copper Carbonate | 1.01  |
| Water            | 80    |



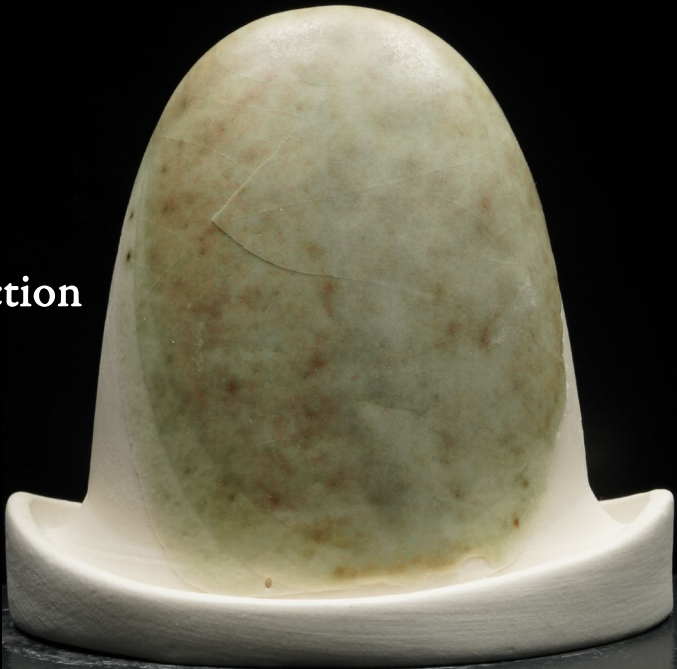
1-3 Second Dip



2-3 Second Dips

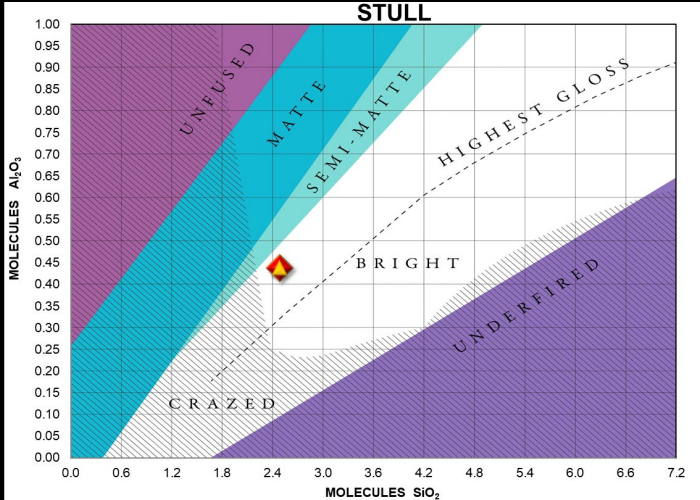


Reduction



Oxidation

| UMF                                                    |      | Alkali Metals                                |      | Alkaline Earths               |      |
|--------------------------------------------------------|------|----------------------------------------------|------|-------------------------------|------|
| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio |      | 0.22                                         |      | 0.78                          |      |
| SiO <sub>2</sub>                                       | 2.55 | Collective "Al <sub>2</sub> O <sub>3</sub> " | 0.45 | Na <sub>2</sub> O             | 0.17 |
| B <sub>2</sub> O <sub>3</sub>                          | 0.45 | Li <sub>2</sub> O                            | 0.05 | K <sub>2</sub> O              | 0.37 |
| TiO <sub>2</sub>                                       | 0.00 | Al <sub>2</sub> O <sub>3</sub>               | 0.45 | Li <sub>2</sub> O             | 0.02 |
| Cr <sub>2</sub> O <sub>3</sub>                         | 0.00 | NiO                                          | 0.02 | B <sub>2</sub> O <sub>3</sub> | 0.02 |
|                                                        |      | ZrO <sub>2</sub>                             | 0.02 | SnO <sub>2</sub>              | 0.01 |
|                                                        |      | P <sub>2</sub> O <sub>5</sub>                | 0.01 | MnO <sub>2</sub>              | 0.01 |
|                                                        |      |                                              |      | CoO                           | 0.01 |



| EUMF                                                   |      | Alkali Metals                                |      | Alkaline Earths               |      |
|--------------------------------------------------------|------|----------------------------------------------|------|-------------------------------|------|
| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio |      | 0.24                                         |      | 0.76                          |      |
| SiO <sub>2</sub>                                       | 2.49 | Collective "Al <sub>2</sub> O <sub>3</sub> " | 0.44 | Na <sub>2</sub> O             | 0.17 |
| B <sub>2</sub> O <sub>3</sub>                          | 0.44 | Li <sub>2</sub> O                            | 0.05 | K <sub>2</sub> O              | 0.36 |
| TiO <sub>2</sub>                                       | 0.00 | Al <sub>2</sub> O <sub>3</sub>               | 0.44 | Li <sub>2</sub> O             | 0.02 |
| Cr <sub>2</sub> O <sub>3</sub>                         | 0.00 | NiO                                          | 0.02 | B <sub>2</sub> O <sub>3</sub> | 0.02 |
|                                                        |      | ZrO <sub>2</sub>                             | 0.02 | SnO <sub>2</sub>              | 0.01 |
|                                                        |      | P <sub>2</sub> O <sub>5</sub>                | 0.01 | MnO <sub>2</sub>              | 0.01 |
|                                                        |      |                                              |      | CoO                           | 0.01 |

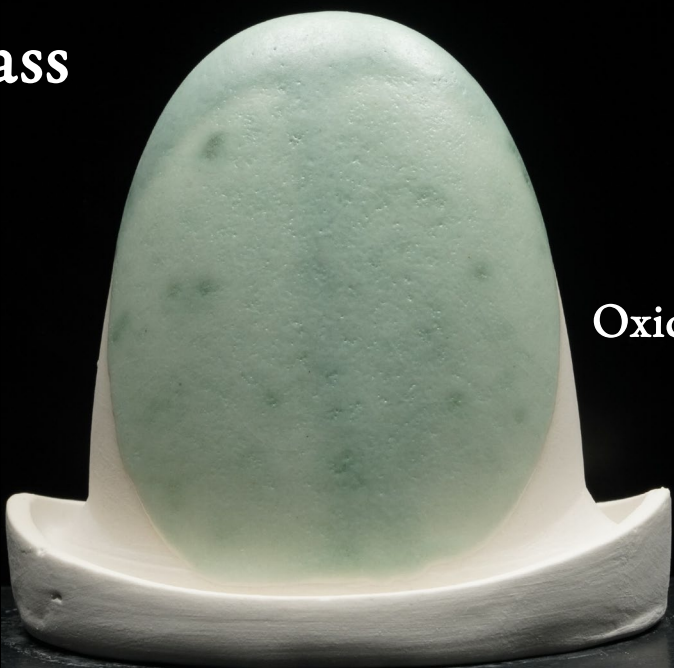


Ceramic  
Materials  
Workshop

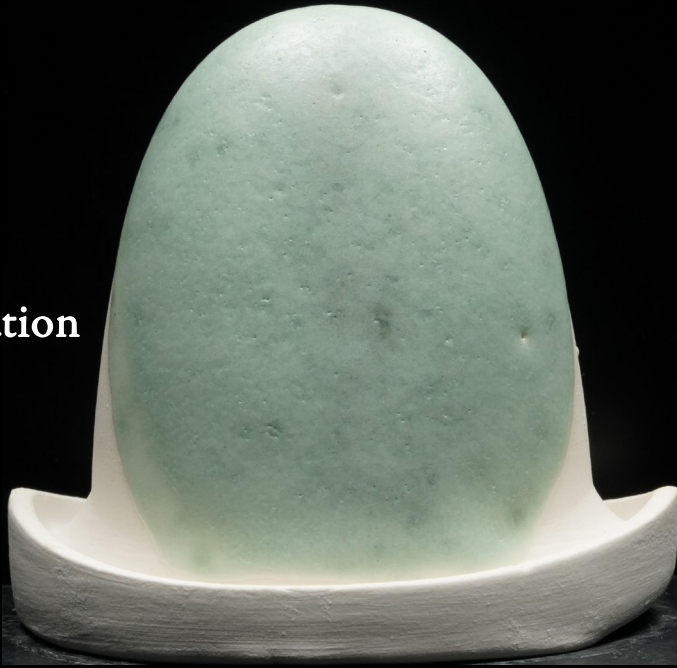
# Heart of Glass

Mapping  
Kaolin 6  
070822-28

|                  |       |
|------------------|-------|
| Neph Sy          | 33.53 |
| Whiting          | 11.92 |
| Zinc Oxide       | 10.43 |
| EPK              | 25.00 |
| Flint            | 19.12 |
| Copper Carbonate | 1.01  |
| Water            | 80    |



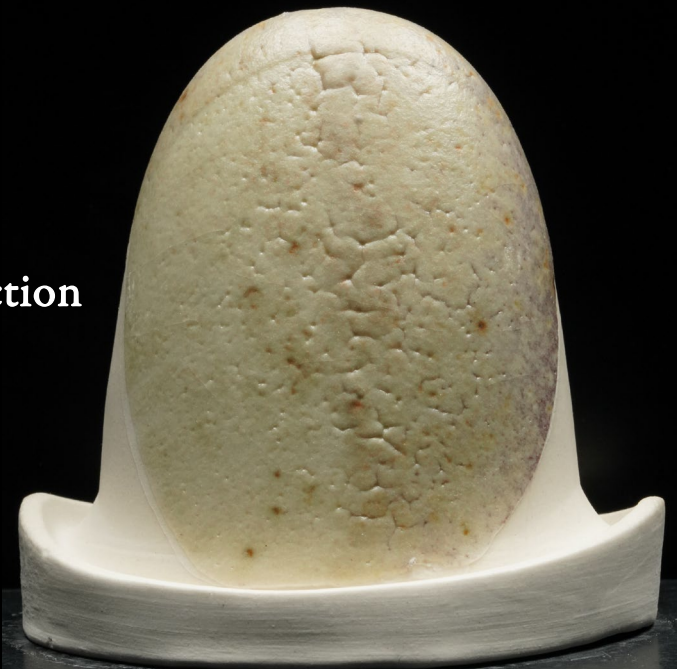
1-3 Second Dip



2-3 Second Dips



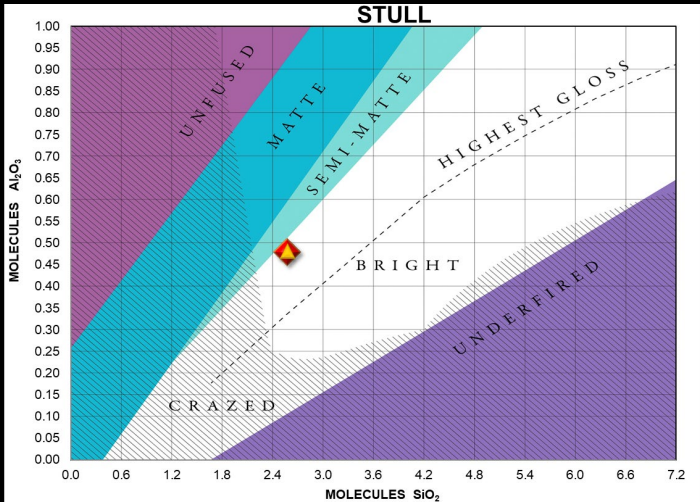
Reduction



Oxidation

UMF

| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>5.35 : 1 |                                                      | Alkali Metals<br>0.22          |                          | Alkaline Earths<br>0.78 |             |
|--------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|-------------------------|-------------|
| SiO <sub>2</sub><br>2.64                                           | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.49 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00             | CaO<br>0.37 |
| B <sub>2</sub> O <sub>3</sub>                                      | Al <sub>2</sub> O <sub>3</sub><br>0.49               | Li <sub>2</sub> O              | CuO                      | SrO                     | BaO         |
| TiO <sub>2</sub><br>0.00                                           | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.39             | FeO<br>0.01 |
| Cr <sub>2</sub> O <sub>3</sub>                                     | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO <sub>2</sub>        | CoO         |



EUMF

| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>5.35 : 1 |                                                      | Alkali Metals<br>0.24          |                          | Alkaline Earths<br>0.76 |             |
|--------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|-------------------------|-------------|
| SiO <sub>2</sub><br>2.58                                           | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.48 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00             | CaO<br>0.36 |
| B <sub>2</sub> O <sub>3</sub>                                      | Al <sub>2</sub> O <sub>3</sub><br>0.48               | Li <sub>2</sub> O              | CuO<br>0.02              | SrO                     | BaO         |
| TiO <sub>2</sub><br>0.00                                           | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.38             | FeO<br>0.01 |
| Cr <sub>2</sub> O <sub>3</sub>                                     | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO <sub>2</sub>        | CoO         |

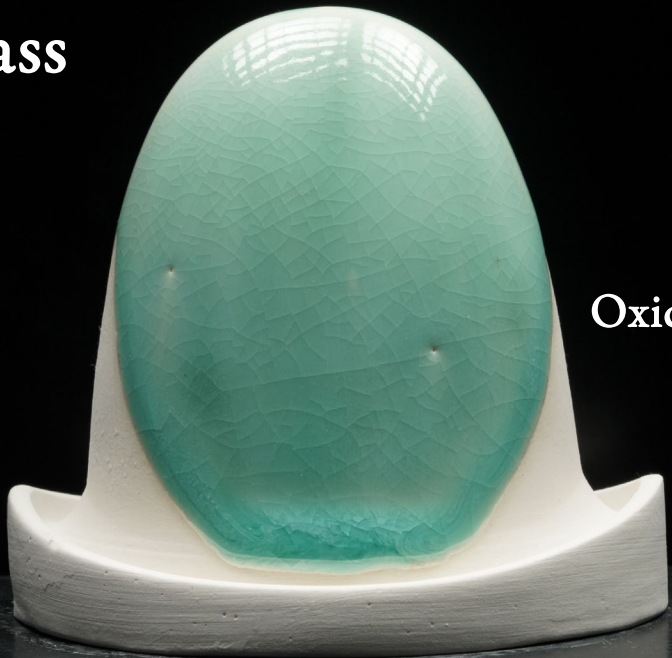


Ceramic  
Materials  
Workshop

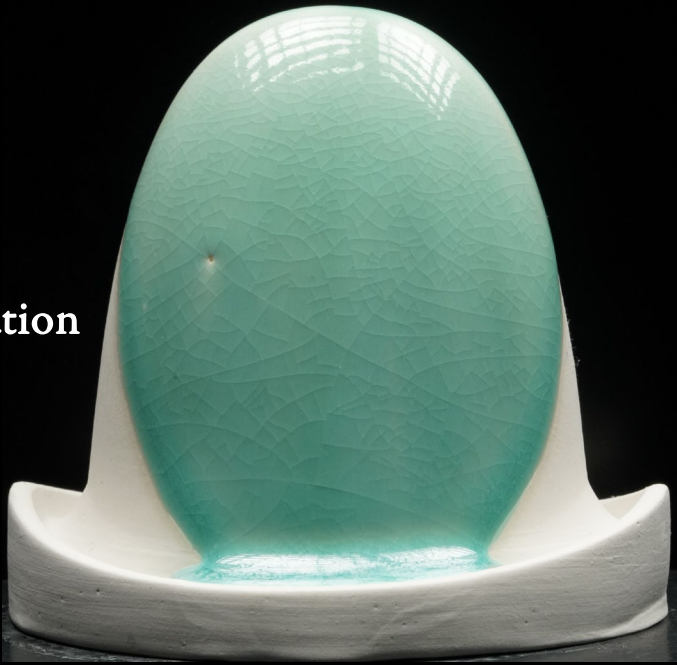
# Heart of Glass

Mapping  
Silica 2  
070822-29

|                  |       |
|------------------|-------|
| Neph Sy          | 48.05 |
| Whiting          | 17.08 |
| Zinc Oxide       | 14.95 |
| EPK              | 10.78 |
| Flint            | 9.13  |
| Copper Carbonate | 1.01  |
| Water            | 70    |



1-3 Second Dip



2-3 Second Dips

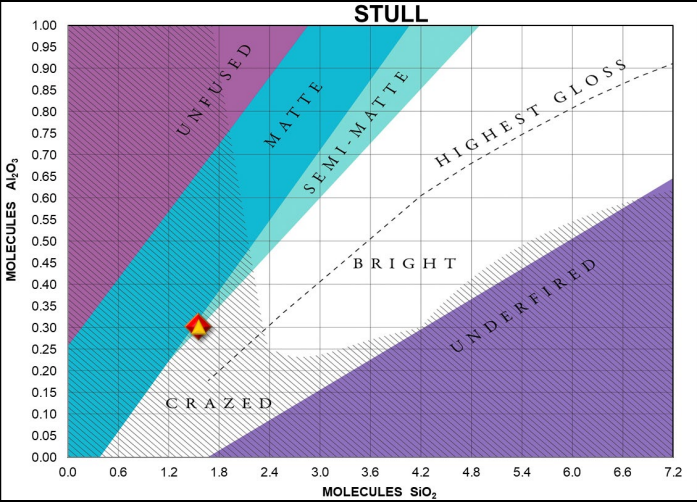
Oxidation



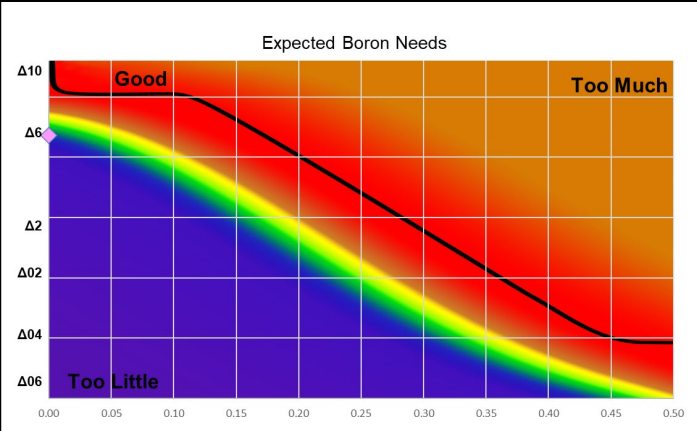
Reduction



| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>5.15 : 1 |                                                      | Alkali Metals<br>0.22          |                          | Alkaline Earths<br>0.78 |             |
|--------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|-------------------------|-------------|
| SiO <sub>2</sub><br>1.58                                           | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.31 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00             | CaO<br>0.38 |
| B <sub>2</sub> O <sub>3</sub>                                      | Al <sub>2</sub> O <sub>3</sub><br>0.31               | Li <sub>2</sub> O              | CuO                      | SrO                     | BaO         |
| TiO <sub>2</sub><br>0.00                                           | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.40             | FeO<br>0.00 |
| Cr <sub>2</sub> O <sub>3</sub>                                     | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO <sub>2</sub>        | CoO         |



| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>5.15 : 1 |                                                      | Alkali Metals<br>0.24          |                          | Alkaline Earths<br>0.76 |             |
|--------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|-------------------------|-------------|
| SiO <sub>2</sub><br>1.56                                           | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.30 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00             | CaO<br>0.37 |
| B <sub>2</sub> O <sub>3</sub>                                      | Al <sub>2</sub> O <sub>3</sub><br>0.30               | Li <sub>2</sub> O              | CuO<br>0.02              | SrO                     | BaO         |
| TiO <sub>2</sub><br>0.00                                           | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.39             | FeO<br>0.00 |
| Cr <sub>2</sub> O <sub>3</sub>                                     | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO <sub>2</sub>        | CoO         |



Ceramic  
Materials  
Workshop

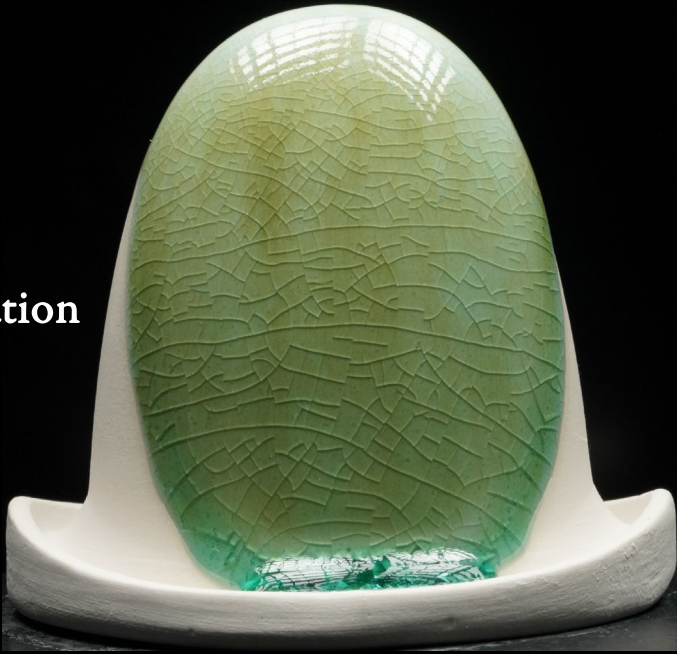
# Heart of Glass

Mapping  
Silica 3  
070822-30

|                  |       |
|------------------|-------|
| Neph Sy          | 44.03 |
| Whiting          | 15.65 |
| Zinc Oxide       | 13.70 |
| EPK              | 9.88  |
| Flint            | 16.74 |
| Copper Carbonate | 1.01  |
| Water            | 70    |



1-3 Second Dip



2-3 Second Dips



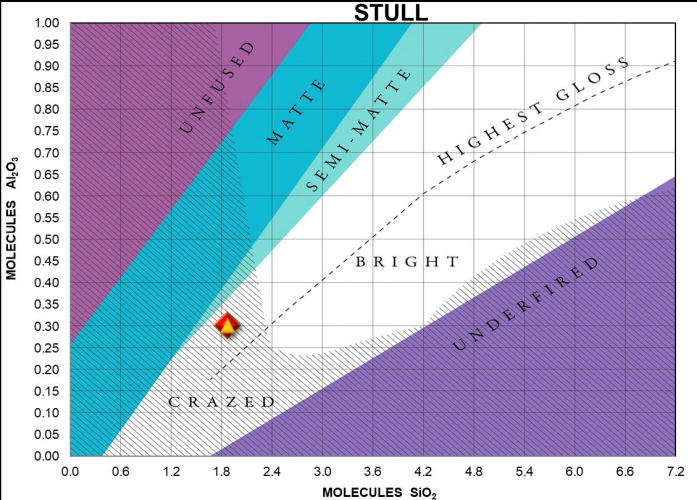
Reduction



Oxidation

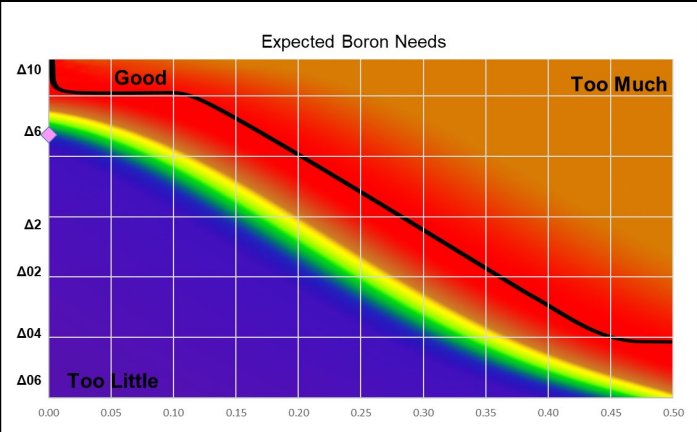
UMF

| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>6.18 : 1 |                                                      | Alkali Metals<br>0.22          |                          | Alkaline Earths<br>0.78 |             |
|--------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|-------------------------|-------------|
| SiO <sub>2</sub><br>1.91                                           | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.31 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00             | CaO<br>0.38 |
| B <sub>2</sub> O <sub>3</sub>                                      | Al <sub>2</sub> O <sub>3</sub><br>0.31               | Li <sub>2</sub> O              | CuO                      | SrO                     | BaO         |
| TiO <sub>2</sub><br>0.00                                           | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.40             | FeO<br>0.00 |
| Cr <sub>2</sub> O <sub>3</sub>                                     | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO <sub>2</sub>        | CoO         |



EUMF

| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>6.18 : 1 |                                                      | Alkali Metals<br>0.24          |                          | Alkaline Earths<br>0.76 |             |
|--------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|-------------------------|-------------|
| SiO <sub>2</sub><br>1.87                                           | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.30 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00             | CaO<br>0.37 |
| B <sub>2</sub> O <sub>3</sub>                                      | Al <sub>2</sub> O <sub>3</sub><br>0.30               | Li <sub>2</sub> O              | CuO<br>0.02              | SrO                     | BaO         |
| TiO <sub>2</sub><br>0.00                                           | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.39             | FeO<br>0.00 |
| Cr <sub>2</sub> O <sub>3</sub>                                     | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO <sub>2</sub>        | CoO         |



Ceramic  
Materials  
Workshop

# Heart of Glass

Mapping  
Silica 4  
070822-31

|                  |       |
|------------------|-------|
| Neph Sy          | 37.71 |
| Whiting          | 13.41 |
| Zinc Oxide       | 11.73 |
| EPK              | 8.46  |
| Flint            | 28.68 |
| Copper Carbonate | 1.01  |
| Water            | 70    |



1-3 Second Dip



2-3 Second Dips

Oxidation

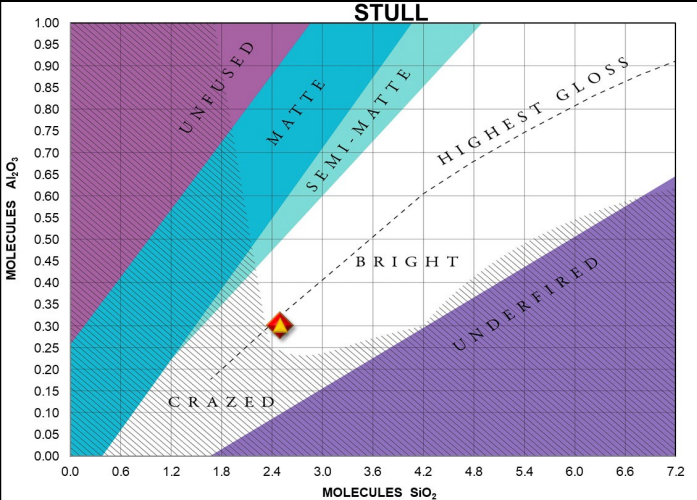


Reduction



UMF

| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>8.22 : 1 |                                                      | Alkali Metals<br>0.22          |                          | Alkaline Earths<br>0.78 |             |
|--------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|-------------------------|-------------|
| SiO <sub>2</sub><br>2.55                                           | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.31 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00             | CaO<br>0.38 |
| B <sub>2</sub> O <sub>3</sub>                                      | Al <sub>2</sub> O <sub>3</sub><br>0.31               | Li <sub>2</sub> O              | CuO                      | SrO                     | BaO         |
| TiO <sub>2</sub>                                                   | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.40             | FeO<br>0.01 |
| Cr <sub>2</sub> O <sub>3</sub>                                     | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO <sub>2</sub>        | CoO         |



EUMF

| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>8.22 : 1 |                                                      | Alkali Metals<br>0.24          |                          | Alkaline Earths<br>0.76 |             |
|--------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|-------------------------|-------------|
| SiO <sub>2</sub><br>2.50                                           | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.30 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00             | CaO<br>0.37 |
| B <sub>2</sub> O <sub>3</sub>                                      | Al <sub>2</sub> O <sub>3</sub><br>0.30               | Li <sub>2</sub> O              | CuO<br>0.02              | SrO                     | BaO         |
| TiO <sub>2</sub><br>0.00                                           | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.39             | FeO<br>0.01 |
| Cr <sub>2</sub> O <sub>3</sub>                                     | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO <sub>2</sub>        | CoO         |



Ceramic  
Materials  
Workshop

# Heart of Glass

Mapping  
Silica 5  
070822-32

|                  |       |
|------------------|-------|
| Neph Sy          | 35.19 |
| Whiting          | 12.51 |
| Zinc Oxide       | 10.95 |
| EPK              | 7.90  |
| Flint            | 33.45 |
| Copper Carbonate | 1.01  |
| Water            | 70    |



1-3 Second Dip



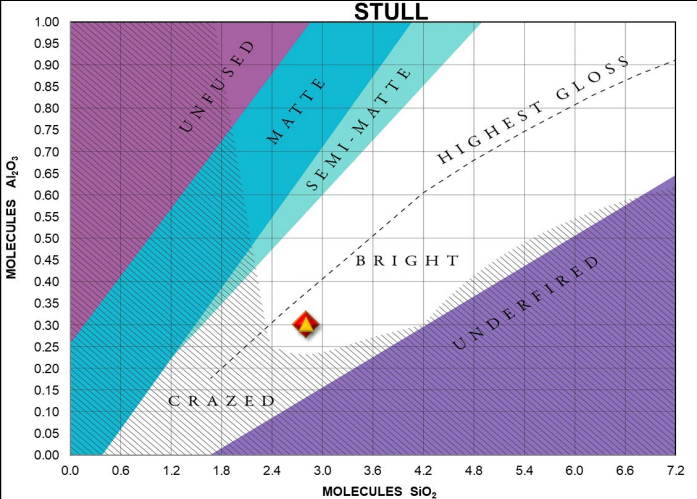
2-3 Second Dips



Reduction



| UMF                                                                |                                                      | Alkali Metals                  |                          | Alkaline Earths  |             |
|--------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|------------------|-------------|
| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>9.23 : 1 |                                                      | 0.22                           |                          | 0.78             |             |
| SiO <sub>2</sub><br>2.87                                           | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.31 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00      | CaO<br>0.38 |
| B <sub>2</sub> O <sub>3</sub>                                      | Al <sub>2</sub> O <sub>3</sub><br>0.31               | Li <sub>2</sub> O              | CuO                      | SrO              | BaO         |
| TiO <sub>2</sub>                                                   | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.40      | FeO<br>0.01 |
| Cr <sub>2</sub> O <sub>3</sub>                                     | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO <sub>2</sub> | CoO         |



| EUMF                                                               |                                                      | Alkali Metals                  |                          | Alkaline Earths  |             |
|--------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|------------------|-------------|
| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>9.23 : 1 |                                                      | 0.24                           |                          | 0.76             |             |
| SiO <sub>2</sub><br>2.81                                           | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.30 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00      | CaO<br>0.37 |
| B <sub>2</sub> O <sub>3</sub>                                      | Al <sub>2</sub> O <sub>3</sub><br>0.30               | Li <sub>2</sub> O              | CuO<br>0.02              | SrO              | BaO         |
| TiO <sub>2</sub><br>0.00                                           | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.39      | FeO<br>0.01 |
| Cr <sub>2</sub> O <sub>3</sub>                                     | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO <sub>2</sub> | CoO         |



# Heart of Glass

Mapping  
Silica 6  
070822-33

|                  |       |
|------------------|-------|
| Neph Sy          | 32.98 |
| Whiting          | 11.73 |
| Zinc Oxide       | 10.26 |
| EPK              | 7.40  |
| Flint            | 37.62 |
| Copper Carbonate | 1.01  |
| Water            | 70    |



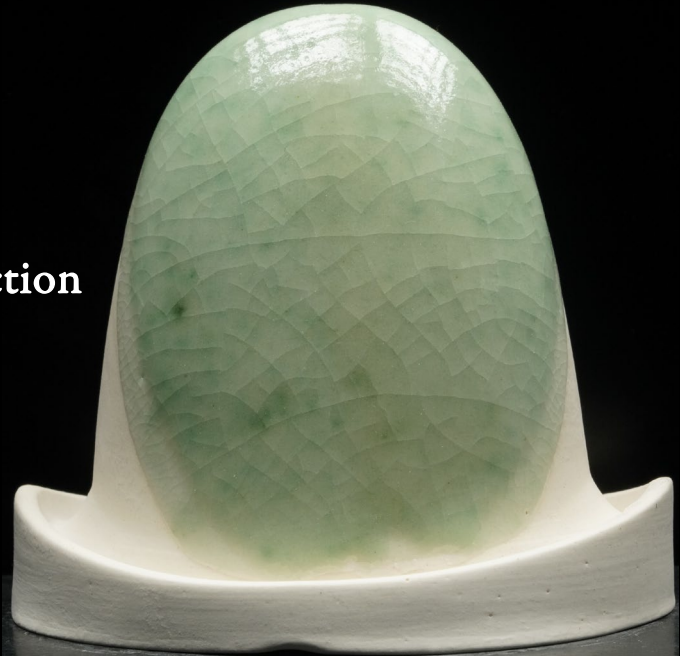
1-3 Second Dip



2-3 Second Dips

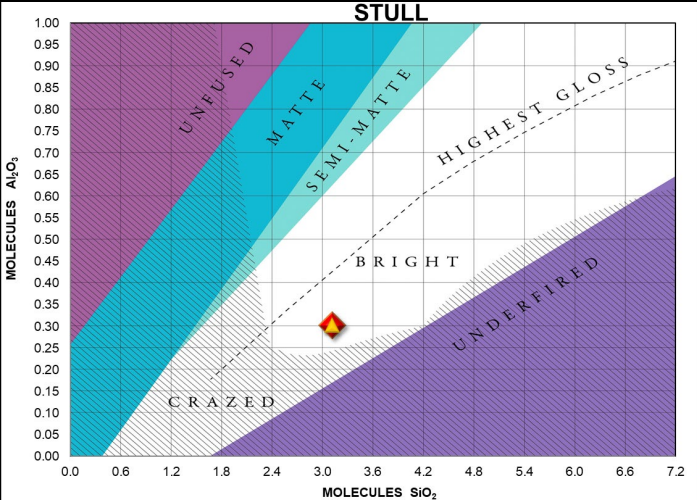


Reduction



UMF

| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>10.24 : 1 |                                                      | Alkali Metals<br>0.22          |                          | Alkaline Earths<br>0.78 |             |
|---------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|-------------------------|-------------|
| SiO <sub>2</sub><br>3.20                                            | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.31 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00             | CaO<br>0.38 |
| B <sub>2</sub> O <sub>3</sub>                                       | Al <sub>2</sub> O <sub>3</sub><br>0.31               | Li <sub>2</sub> O              | CuO                      | SrO                     | BaO         |
| TiO <sub>2</sub><br>0.00                                            | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.40             | FeO<br>0.01 |
| Cr <sub>2</sub> O <sub>3</sub>                                      | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO <sub>2</sub>        | CoO         |



EUMF

| SiO <sub>2</sub> :Al <sub>2</sub> O <sub>3</sub> Ratio<br>10.24 : 1 |                                                      | Alkali Metals<br>0.24          |                          | Alkaline Earths<br>0.76 |             |
|---------------------------------------------------------------------|------------------------------------------------------|--------------------------------|--------------------------|-------------------------|-------------|
| SiO <sub>2</sub><br>3.12                                            | Collective "Al <sub>2</sub> O <sub>3</sub> "<br>0.30 | Na <sub>2</sub> O<br>0.17      | K <sub>2</sub> O<br>0.05 | MgO<br>0.00             | CaO<br>0.37 |
| B <sub>2</sub> O <sub>3</sub>                                       | Al <sub>2</sub> O <sub>3</sub><br>0.30               | Li <sub>2</sub> O              | CuO<br>0.03              | SrO                     | BaO         |
| TiO <sub>2</sub><br>0.00                                            | NiO                                                  | Bi <sub>2</sub> O <sub>3</sub> | SnO <sub>2</sub>         | ZnO<br>0.39             | FeO<br>0.01 |
| Cr <sub>2</sub> O <sub>3</sub>                                      | ZrO <sub>2</sub>                                     | P <sub>2</sub> O <sub>5</sub>  |                          | MnO <sub>2</sub>        | CoO         |



Ceramic  
Materials  
Workshop