

| <b>Glass - Chemical Resistance</b>  |                             |                       |                |                 |               |
|---|-----------------------------|-----------------------|----------------|-----------------|---------------|
|   | <b>Acids - concentrated</b> | <b>Acids - dilute</b> | <b>Alkalis</b> | <b>Halogens</b> | <b>Metals</b> |
| <b>Fused Silica</b><br>SiO <sub>2</sub>   | Good                        | Good                  | Fair           | Good            | Fair          |
| <b>MACOR<sup>®</sup></b> Machinable Glass<br>Ceramic<br>SiO <sub>2</sub> 46/Al <sub>2</sub> O <sub>3</sub> 16/MgO 17/K <sub>2</sub> O<br>10/B <sub>2</sub> O <sub>3</sub> 7 | Poor                        | Fair                  | Fair           | -               | -             |

| Glass - Electrical Properties   |   |                                      |
|---|---|--------------------------------------|
|   | Electrical resistivity<br>$\mu\text{Ohmcm}$ | Volume resistivity<br>$\text{Ohmcm}$ |
| Cobalt/Boron/Silicon/Iron/<br>Molybdenum/Nickel<br>Co69/B 12/Si12/Fe 4/Mo 2/Ni<br>1 (Atomic %)  | 136   | -                                    |
| Cobalt/Silicon/Boron/Iron/<br>Nickel<br>Co66/Si15/B 14/Fe 4/Ni 1<br>(Atomic %)  | 142   | -                                    |
| Cobalt/Silicon/Boron/<br>Manganese<br>Co70/Si + B 23/Mn 5/Fe + Mo<br>2 (Atomic %)   | 130   | -                                    |
| Cobalt/Silicon/Molybdenum/<br>Iron/Boron/Niobium<br>Co78/Si 9/Mo 5/Fe 4/B 2/Nb 2<br>(Atomic %)  | 135   | -                                    |
| Fused Silica<br>SiO <sub>2</sub>  | -   | 10 <sup>14</sup> @25C                |
| Iron/Boron/Silicon<br>Fe77.5/B 15/Si 7.5 (Atomic %)   | 124   | -                                    |
| Iron/Boron/Silicon<br>Fe78/B 13/Si 9 (Atomic %)   | 137   | -                                    |
| Iron/Boron/Silicon<br>Fe79/B 16/Si 5 (Atomic %)   | 125   | -                                    |
| Iron/Boron/Silicon<br>Fe81/B 13.5/Si 3.5/C 2<br>(Atomic %)  | 135   | -                                    |
| Iron/Nickel/Boron<br>Fe40/Ni38/B 18/Mo 4 (Atomic<br>%)  | 740   | -                                    |
| MACOR <sup>®</sup> Machinable Glass<br>Ceramic<br>SiO <sub>2</sub> 46/Al <sub>2</sub> O <sub>3</sub> 16/MgO 17/K <sub>2</sub> O<br>10/B <sub>2</sub> O <sub>3</sub> 7 | -   | > 10 <sup>14</sup> @25C              |
| Nickel/Boron/Silicon<br>Ni78/B 14/Si 8 (Atomic %)   | 90  | -                                    |
| Nickel/Iron/Silicon/Boron<br>Ni40/Fe40/Si + B 19/Mo 1-2<br>(Atomic %)   | 135   | -                                    |

| <b>Glass - Magnetic Properties</b>  |  |                                |                             |                                |                                      |   |
|---|--|--------------------------------|-----------------------------|--------------------------------|--------------------------------------|---|
|   | <b>Coercivity - as cast<br/>A m<sup>-1</sup></b> | <b>Curie temperature<br/>C</b> | <b>Maximum permeability</b> | <b>Remanence ratio - Br/Bs</b> | <b>Saturation flux density<br/>T</b> | <b>Saturation magnetostriction<br/>x10<sup>-6</sup></b> |
| <b>Cobalt/Boron/Silicon/Iron/<br/>Molybdenum/Nickel<br/>Co69/B 12/Si12/Fe 4/Mo 2/Ni<br/>1 (Atomic %)</b>  | 0.8  | 365                            | -                           | 0.83                           | 0.70                                 | < 1   |
| <b>Cobalt/Silicon/Boron/Iron/<br/>Nickel<br/>Co66/Si15/B 14/Fe 4/Ni 1<br/>(Atomic %)</b>  | 0.24   | 205                            | -                           | 0.82                           | 0.55                                 | < 1   |
| <b>Cobalt/Silicon/Boron/<br/>Manganese<br/>Co70/Si + B 23/Mn 5/Fe + Mo<br/>2 (Atomic %)</b>   | < 1  | 350                            | -                           | 0.7-0.95                       | 0.8                                  | < 0.3   |
| <b>Cobalt/Silicon/Molybdenum/<br/>Iron/Boron/Niobium<br/>Co78/Si 9/Mo 5/Fe 4/B 2/Nb 2<br/>(Atomic %)</b>  | -  | 240                            | -                           | -                              | 0.58                                 | -   |
| <b>Fused Silica<br/>SiO<sub>2</sub></b>   | 1.46   | -                              | 365-2500nm                  | 1715                           | 3.8                                  | -   |
| <b>Iron/Boron/Silicon<br/>Fe77.5/B 15/Si 7.5 (Atomic %)</b>   | -  | 422                            | -                           | -                              | -                                    | -   |
| <b>Iron/Boron/Silicon<br/>Fe78/B 13/Si 9 (Atomic %)</b>   | 14   | 415                            | -                           | 0.76                           | 1.56                                 | 27  |
| <b>Iron/Boron/Silicon<br/>Fe79/B 16/Si 5 (Atomic %)</b>   | 16   | 405                            | -                           | 0.19                           | 1.58                                 | 27  |
| <b>Iron/Boron/Silicon<br/>Fe81/B 13.5/Si 3.5/C 2<br/>(Atomic %)</b>   | 6.37   | 370                            | -                           | 0.7                            | 1.6                                  | 30  |
| <b>MACOR<sup>®</sup> Machinable Glass<br/>Ceramic<br/>SiO<sub>2</sub> 46/Al<sub>2</sub>O<sub>3</sub> 16/MgO 17/K<sub>2</sub>O<br/>10/B<sub>2</sub>O<sub>3</sub> 7</b> | -  | 40                             | -                           | -                              | 5.9                                  | -   |
| <b>Nickel/Iron/Silicon/Boron<br/>Ni40/Fe40/Si + B 19/Mo 1-2<br/>(Atomic %)</b>  | < 1  | 260                            | -                           | < 1                            | 0.8                                  | 8   |

| <b>Glass - Mechanical Properties</b>  |                                     |                                  |   |                                |                                 |
|---|-------------------------------------|----------------------------------|---|--------------------------------|---------------------------------|
|   | <b>Compressive strength<br/>MPa</b> | <b>Elongation at break<br/>%</b> | <b>Hardness - Vickers<br/>kgf mm<sup>-2</sup></b> | <b>Tensile modulus<br/>GPa</b> | <b>Tensile strength<br/>MPa</b> |
| <b>Cobalt/Boron/Silicon/Iron/<br/>Molybdenum/Nickel<br/>Co69/B 12/Si12/Fe 4/Mo 2/Ni<br/>1 (Atomic %)</b>  | -                                   | -                                | 900   | 63                             | > 700                           |
| <b>Cobalt/Silicon/Boron/Iron/<br/>Nickel<br/>Co66/Si15/B 14/Fe 4/Ni 1<br/>(Atomic %)</b>  | -                                   | -                                | 960   | 61                             | > 700                           |
| <b>Cobalt/Silicon/Boron/<br/>Manganese<br/>Co70/Si + B 23/Mn 5/Fe + Mo<br/>2 (Atomic %)</b>   | -                                   | -                                | 900   | 150                            | 1500-2000                       |
| <b>Fused Silica<br/>SiO<sub>2</sub></b>   | -                                   | -                                | 490   | 65-75                          | -                               |
| <b>Iron/Boron/Silicon<br/>Fe77.5/B 15/Si 7.5 (Atomic %)</b>   | -                                   | 2.3                              | 940   | 155                            | -                               |
| <b>Iron/Boron/Silicon<br/>Fe78/B 13/Si 9 (Atomic %)</b>   | -                                   | -                                | 860   | 57                             | > 700                           |
| <b>Iron/Boron/Silicon<br/>Fe79/B 16/Si 5 (Atomic %)</b>   | -                                   | -                                | 900   | -                              | 1500                            |
| <b>Iron/Boron/Silicon<br/>Fe81/B 13.5/Si 3.5/C 2<br/>(Atomic %)</b>   | -                                   | -                                | 880   | 58                             | > 700                           |
| <b>Iron/Nickel/Boron<br/>Fe40/Ni38/B 18/Mo 4 (Atomic<br/>%)</b>   | -                                   | -                                | 125   | 0-100\<br>11.7                 | -                               |
| <b>MACOR<sup>®</sup> Machinable Glass<br/>Ceramic<br/>SiO<sub>2</sub> 46/Al<sub>2</sub>O<sub>3</sub> 16/MgO 17/K<sub>2</sub>O<br/>10/B<sub>2</sub>O<sub>3</sub> 7</b> | 345                                 | -                                | 400   | 67                             | -                               |
| <b>Magnetic Copper<br/>Cu99.96/Fe 0.04</b>  | -                                   | 1.1                              | -   | -                              | 539                             |
| <b>Nickel/Boron/Silicon<br/>Ni78/B 14/Si 8 (Atomic %)</b>   | -                                   | -                                | 850   | 150                            | 1500-2000                       |
| <b>Nickel/Iron/Silicon/Boron<br/>Ni40/Fe40/Si + B 19/Mo 1-2<br/>(Atomic %)</b>  | -                                   | -                                | 800   | 150                            | 1500-2000                       |

| <b>Glass - Physical Properties</b>  |                                |                                      |  |
|---|--------------------------------|--------------------------------------|--|
|   | <b>Apparent porosity<br/>%</b> | <b>Density<br/>g cm<sup>-3</sup></b> | <b>Water absorption - saturation<br/>%</b> |
| <b>Borosilicate Glass</b><br>SiO <sub>2</sub> 81% / B <sub>2</sub> O <sub>3</sub> 13% / Na <sub>2</sub> O 4%  | -                              | 2.23                                 | -  |
| <b>Carbon - Vitreous - 1000C</b><br><b>C</b>  | -                              | 1.5                                  | -  |
| <b>Cobalt/Boron/Silicon/Iron/<br/>Molybdenum/Nickel</b><br>Co69/B 12/Si12/Fe 4/Mo 2/Ni 1 (Atomic %)   | -                              | 7.80                                 | -  |
| <b>Cobalt/Silicon/Boron/Iron/<br/>Nickel</b><br>Co66/Si15/B 14/Fe 4/Ni 1 (Atomic %)   | -                              | 7.59                                 | -  |
| <b>Cobalt/Silicon/Boron/<br/>Manganese</b><br>Co70/Si + B 23/Mn 5/Fe + Mo 2 (Atomic %)  | -                              | 7.6                                  | -  |
| <b>Cobalt/Silicon/Molybdenum/<br/>Iron/Boron/Niobium</b><br>Co78/Si 9/Mo 5/Fe 4/B 2/Nb 2 (Atomic %)   | -                              | 7.75                                 | -  |
| <b>Fused Silica</b><br>SiO <sub>2</sub>   | 0                              | 2.18                                 | 0  |
| <b>Iron/Boron/Silicon</b><br>Fe78/B 13/Si 9 (Atomic %)  | -                              | 7.18                                 | -  |
| <b>Iron/Boron/Silicon</b><br>Fe79/B 16/Si 5 (Atomic %)  | -                              | 7.28                                 | -  |
| <b>Iron/Boron/Silicon</b><br>Fe81/B 13.5/Si 3.5/C 2 (Atomic %)  | -                              | 7.32                                 | -  |
| <b>Iron/Nickel/Boron</b><br>Fe40/Ni38/B 18/Mo 4 (Atomic %)  | -                              | 7.90                                 | -  |
| <b>MACOR<sup>®</sup> Machinable Glass</b><br>Ceramic<br>SiO <sub>2</sub> 46/Al <sub>2</sub> O <sub>3</sub> 16/MgO 17/K <sub>2</sub> O 10/B <sub>2</sub> O <sub>3</sub> 7 <sup>2</sup> | 0                              | 2.52                                 | -  |
| <b>Magnetic Copper</b><br>Cu99.96/Fe 0.04   | -                              | 8.96                                 | -  |
| <b>Nickel/Boron/Silicon</b><br>Ni78/B 14/Si 8 (Atomic %)  | -                              | 8.0                                  | -  |

| <b>Glass - Physical Properties</b>  |                                |                                      |  |
|---|--------------------------------|--------------------------------------|--|
|   | <b>Apparent porosity<br/>%</b> | <b>Density<br/>g cm<sup>-3</sup></b> | <b>Water absorption - saturation<br/>%</b> |
| <b>Nickel/Iron/Silicon/Boron<br/>Ni40/Fe40/Si + B 19/Mo 1-2<br/>(Atomic %)</b>  | -                              | 7.4                                  | -  |
| <b>Opal<br/>SiO<sub>2</sub>/H<sub>2</sub>O</b>  | -                              | 2.09                                 | -  |
| <b>Soda Lime Glass<br/>SiO<sub>2</sub> 70/Na<sub>2</sub>O 15/CaO 10/<br/>MgO/B<sub>2</sub>O<sub>3</sub>/Al<sub>2</sub>O<sub>3</sub></b> | -                              | 2.5                                  | -  |
| <b>Topaz (Yellow Imperial)<br/>Al<sub>2</sub>SiO<sub>4</sub>(F,OH)<sub>2</sub></b>  | -                              | 3.55                                 | -  |
| <b>Turquoise<br/>CuAl<sub>6</sub>(PO<sub>4</sub>)<sub>4</sub>(OH)</b>   | -                              | 2.7                                  | -  |

| Glass - Thermal Properties  |   |                                  |                                     |  |  |                                       |
|---|---|----------------------------------|-------------------------------------|--|--|---------------------------------------|
|   | Coefficient of thermal expansion<br>$\times 10^{-6} \text{ K}^{-1}$ | Crystallization temperature<br>C | Maximum use temperature in air<br>C | Specific heat<br>$\text{J K}^{-1} \text{ kg}^{-1}$ | Thermal conductivity<br>$\text{W m}^{-1} \text{ K}^{-1}$ | Upper continuous use temperature<br>C |
| Cobalt/Boron/Silicon/Iron/Molybdenum/Nickel<br>Co69/B 12/Si12/Fe 4/Mo 2/Ni 1 (Atomic %)   | -   | 520                              | 80                                  | -  | -  | -                                     |
| Cobalt/Silicon/Boron/Iron/Nickel<br>Co66/Si15/B 14/Fe 4/Ni 1 (Atomic %)   | -   | 550                              | 80                                  | -  | -  | -                                     |
| Cobalt/Silicon/Boron/Manganese<br>Co70/Si + B 23/Mn 5/Fe + Mo 2 (Atomic %)  | -   | 450                              | 80-120                              | -  | -  | -                                     |
| Cobalt/Silicon/Molybdenum/Iron/Boron/Niobium<br>Co78/Si 9/Mo 5/Fe 4/B 2/Nb 2 (Atomic %)   | 12 @ 20-100C  | -                                | -                                   | -  | -  | -                                     |
| Fused Silica<br>SiO <sub>2</sub>  | 0.5-0.75 @20-1000C  | -                                | -                                   | 750 @25C   | 1.2-1.4 @20C   | 900-1200                              |
| Iron/Boron/Silicon<br>Fe77.5/B 15/Si 7.5 (Atomic %)   | 8.7 @20C  | 553                              | -                                   | -  | -  | -                                     |
| Iron/Boron/Silicon<br>Fe78/B 13/Si 9 (Atomic %)   | -   | 550                              | 150                                 | -  | -  | -                                     |
| Iron/Boron/Silicon<br>Fe79/B 16/Si 5 (Atomic %)   | -   | 515                              | 150                                 | -  | -  | -                                     |
| Iron/Boron/Silicon<br>Fe81/B 13.5/Si 3.5/C 2 (Atomic %)   | -   | 480                              | 125                                 | -  | -  | -                                     |
| Iron/Nickel/Boron<br>Fe40/Ni38/B 18/Mo 4 (Atomic %)   | -   | -                                | -                                   | -  | 100-110  | -                                     |
| MACOR <sup>®</sup> Machinable Glass Ceramic<br>SiO <sub>2</sub> 46/Al <sub>2</sub> O <sub>3</sub> 16/MgO 17/K <sub>2</sub> O 10/B <sub>2</sub> O <sub>3</sub> 7 | 13 @20-1000C  | -                                | -                                   | 790 @25C   | 1.5 @20C   | 800-1000                              |
| Magnetic Copper<br>Cu99.96/Fe 0.04  | -   | -                                | -                                   | -  | 401 @23C   | -                                     |
| Nickel/Boron/Silicon<br>Ni78/B 14/Si 8 (Atomic %)   | -   | 450                              | 200                                 | -  | -  | -                                     |
| Nickel/Iron/Silicon/Boron<br>Ni40/Fe40/Si + B 19/Mo 1-2 (Atomic %)  | -   | 450                              | 120                                 | -  | -  | -                                     |

