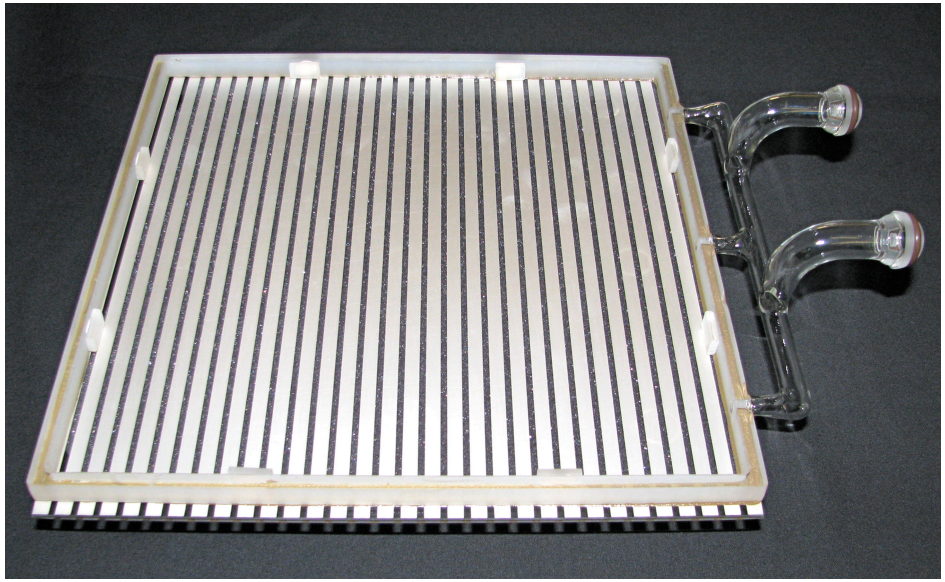
Large-Area Psec Photo Detector

Fritted Bottom Seal

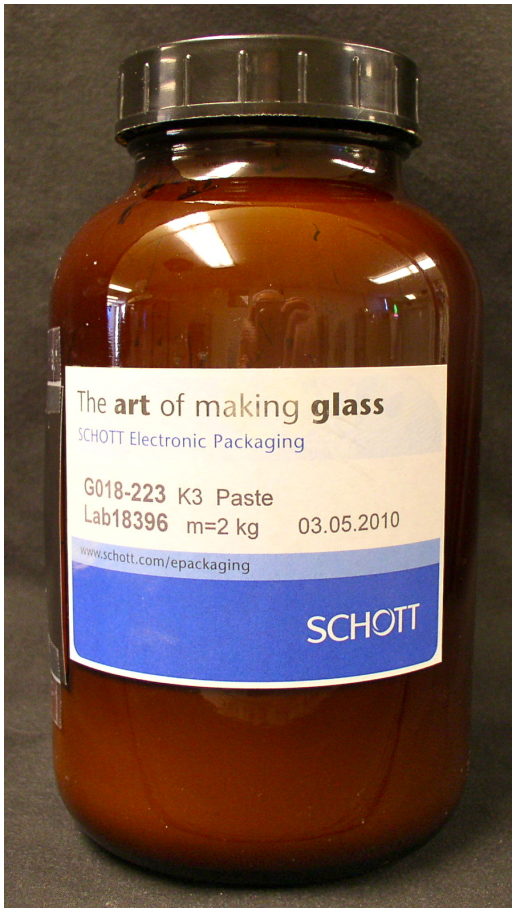


Presented by; Joseph S. Gregar, Scientific Glassblower

Argonne National Laboratory

April 3, 2013

Schott # G018-223 Glass Frit Paste



Lead containing composite solder glass for Duran and Borofloat 33 glasses

Schott Frit # G018-223

Preliminary Data Sheet - 1

Glass No.: G018-223

Lead containing composite solder glass for Silicon, Duran and Borofloat 33.

Physical properties:
(Mean values of specified tolerance ranges)

Thermal expansion coefficient (ISO 7991)		
α_{20-250}	$3{,}14 * 10^{-6}$	K^{-1}
α_{20-300}	$3 * 10^{-6}$	K^{-1}
Transformation temperature (ISO 7884-8)	325	°C
Temperature for viscosity (ISO 7884-6) of $10^{7,6}$ dPas	359	°C
Density	6	$g*cm^{-3}$

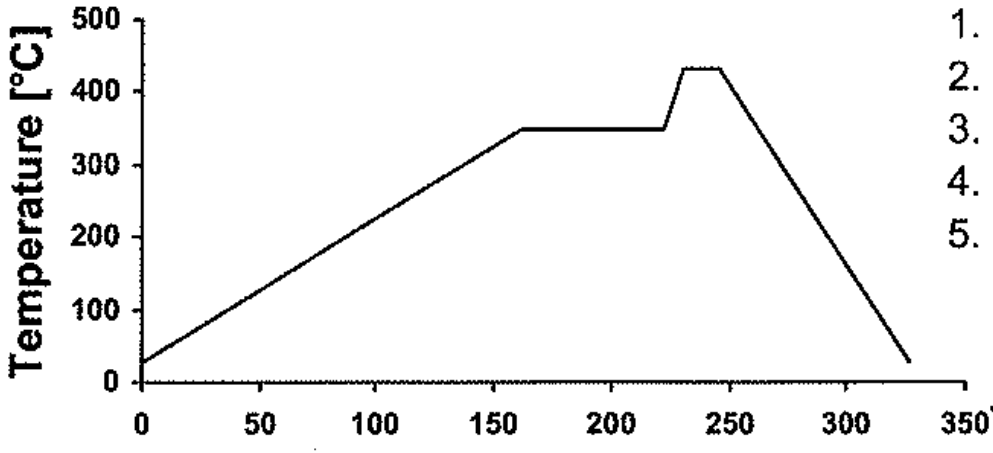
Schott Frit # G018-223

Preliminary Data Sheet - 2

Glass No.: G018-223

Burn out binder and Pre-Glazing

(In case of paste)

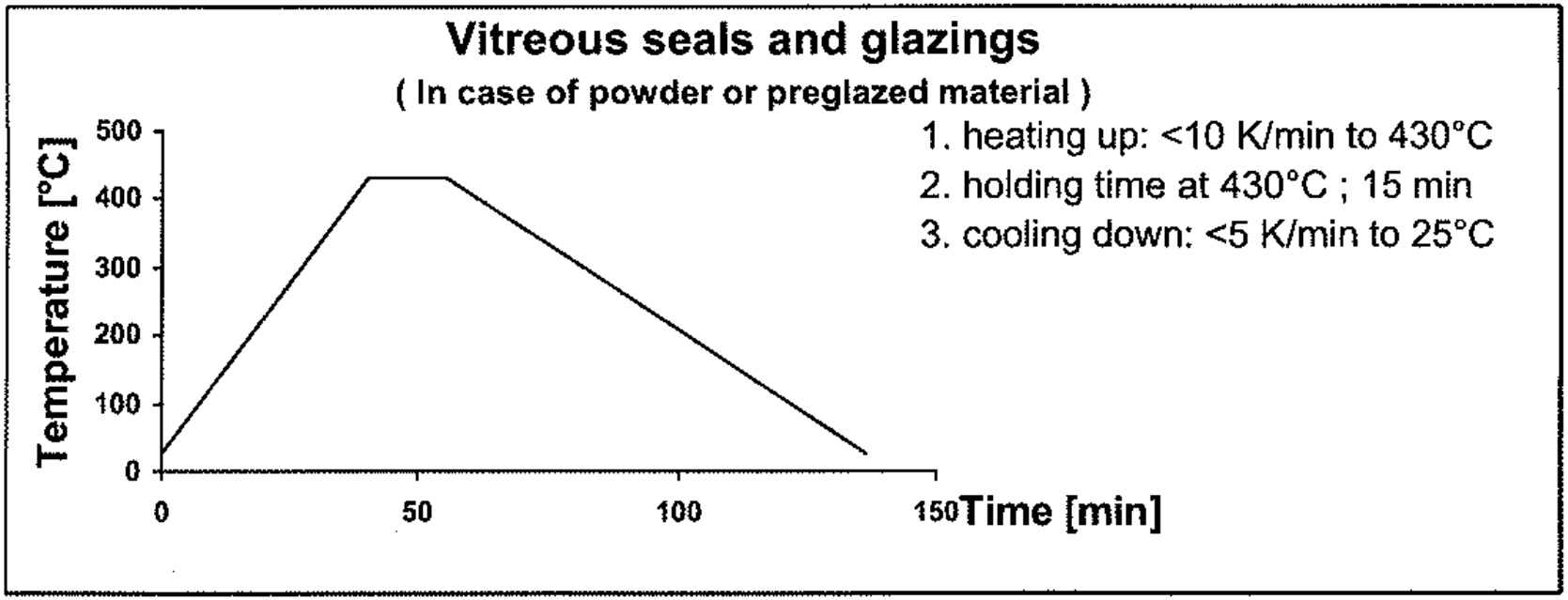


1. heating up: <2 K/min to 350°C
2. holding time at 350°C ; 60 min
3. heating up: <10 K/min to 430°C
4. holding time at 430°C ; 15 min
5. cooling down: <5 K/min to 25°C

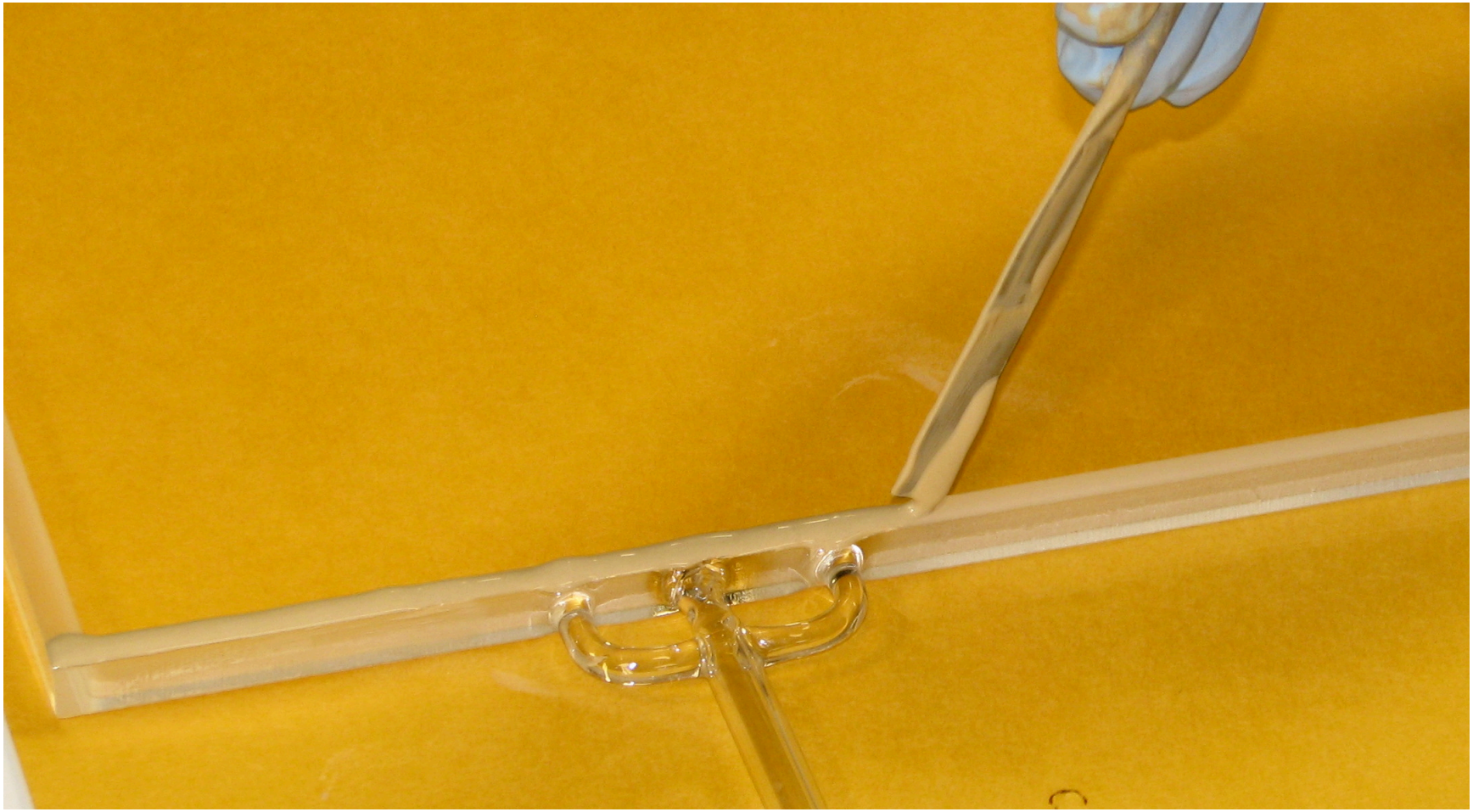
Schott Frit # G018-223

Preliminary Data Sheet - 3

Glass # G018-223



Applying the G018-223 Glass Frit



Firing Parameters - Step 1

- Many trials were performed
- Firing parameters were tested to achieve a successful hermetic bonding

- Three step process:
  1) **Out-gas the frit**

Raise temperature slowly 1°/minute to 370°C

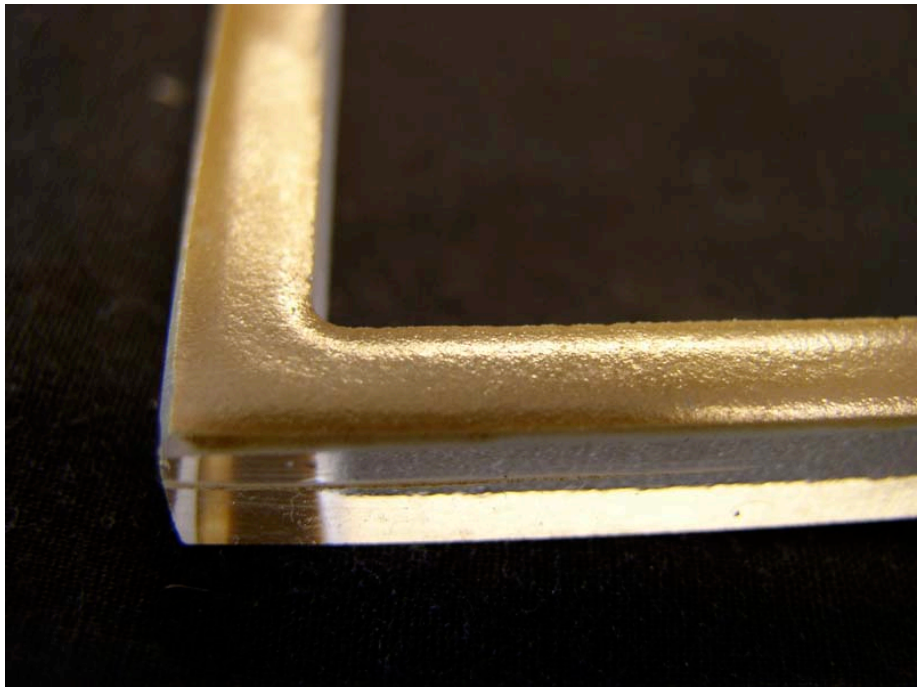
Hold temperature at 370°C for 90 minutes

Firing Parameters – Step 2

2) Glaze the frit

Raise temperature 3.3°C/minute to 470°C.

Hold at 470°C for 60 minutes



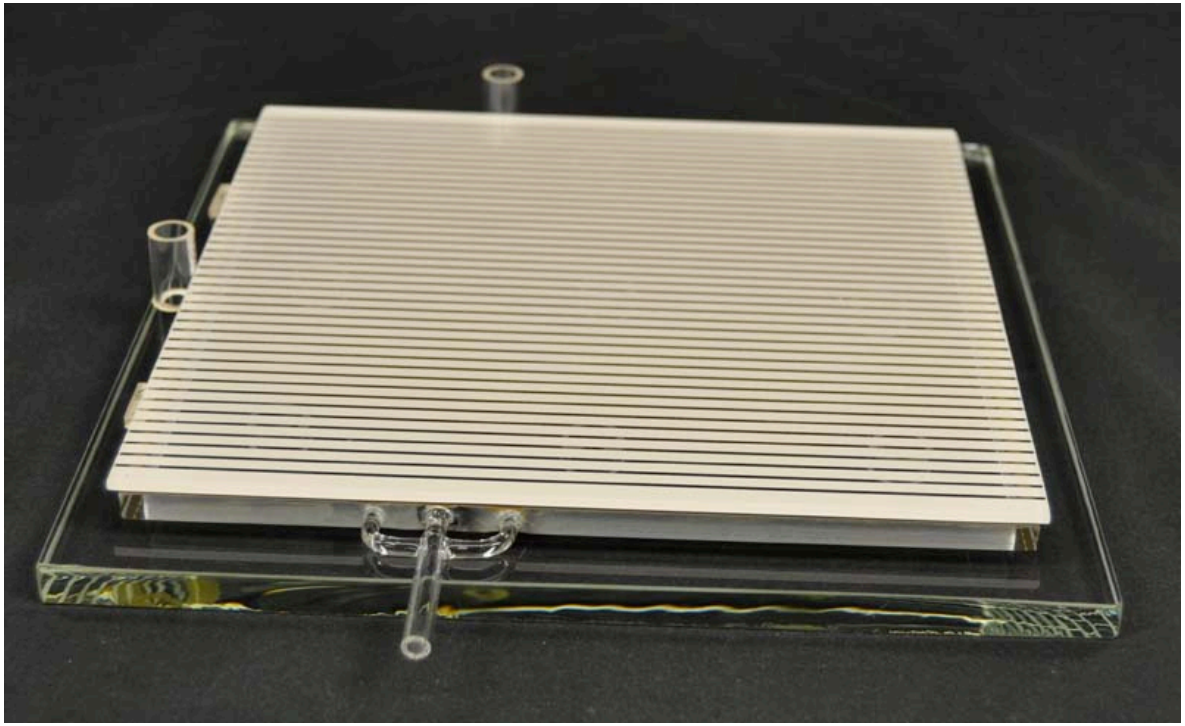
Schott frit after 470 ° C oven firing

Fire the Silvered Anode Plate - Step 3

3) Seal Anode plate to frame

Anode plate is positioned on top of the frame

Re-fire the glazed frit to bond to the Anode plate

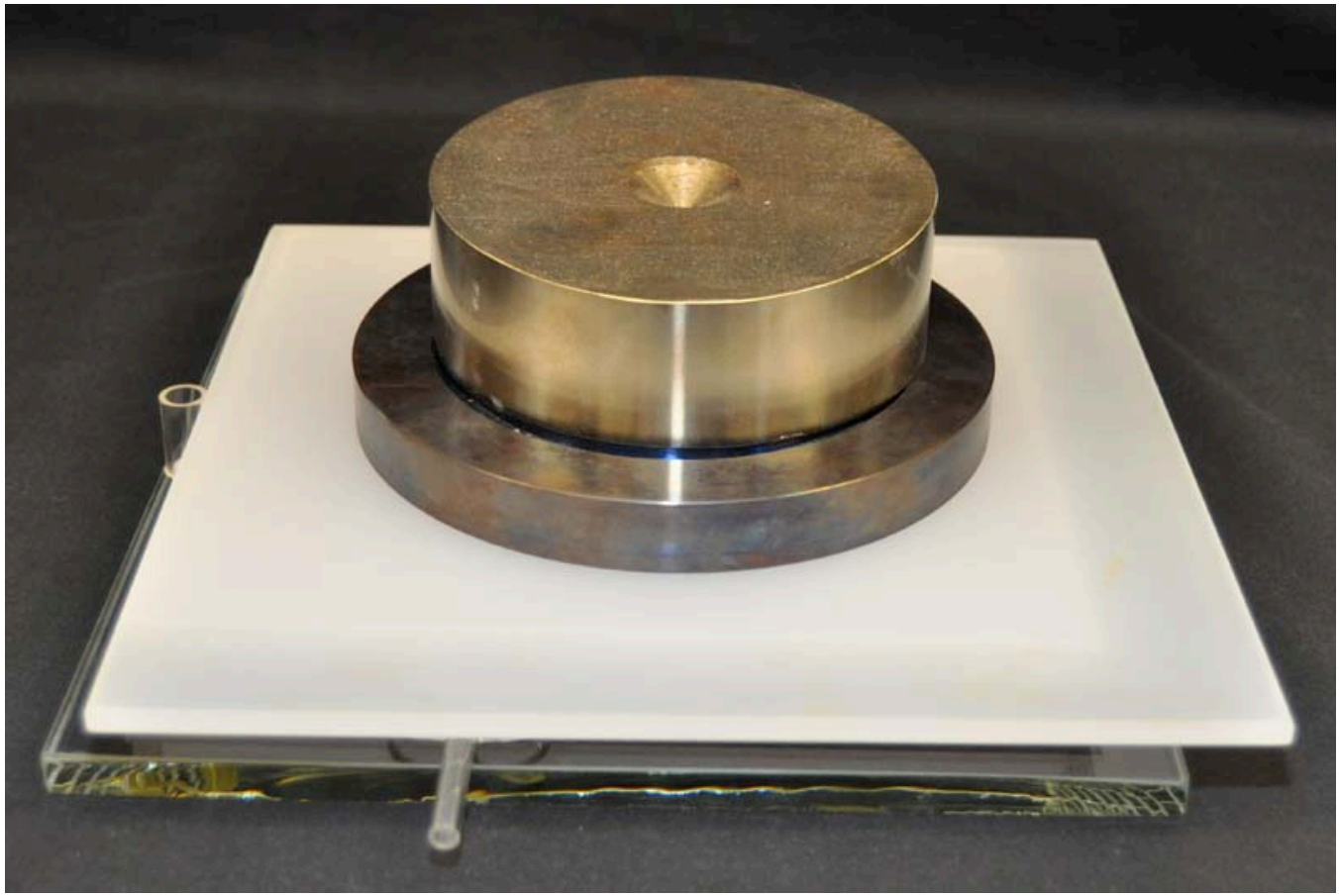


Raise temperature 4°/minute to 470°C

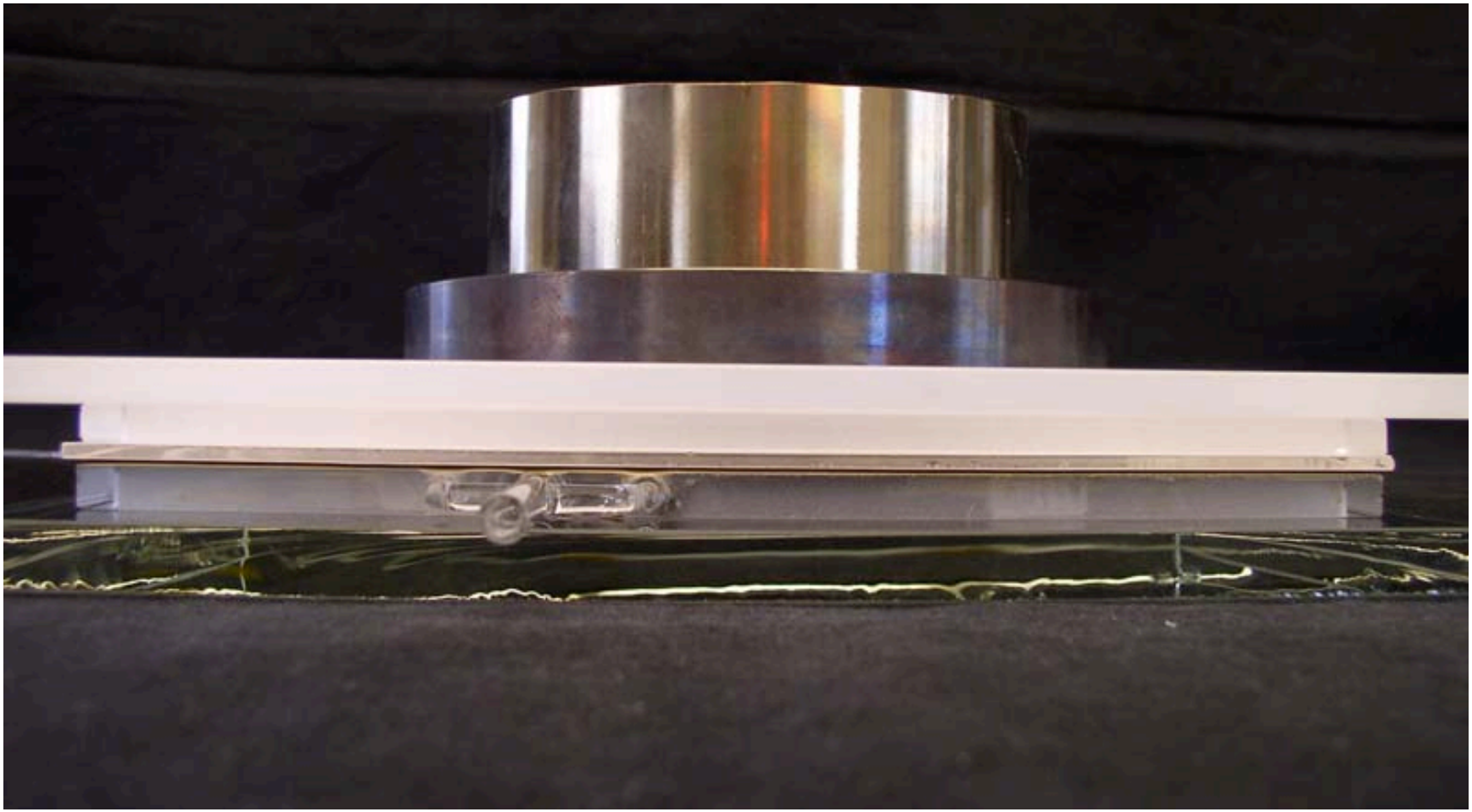
Hold temperature at 470°C for 60 minutes

Complete Assembly for Furnace

- Add 6,350 grams (16 pounds) of stainless steel weight



Side View of Sandwich



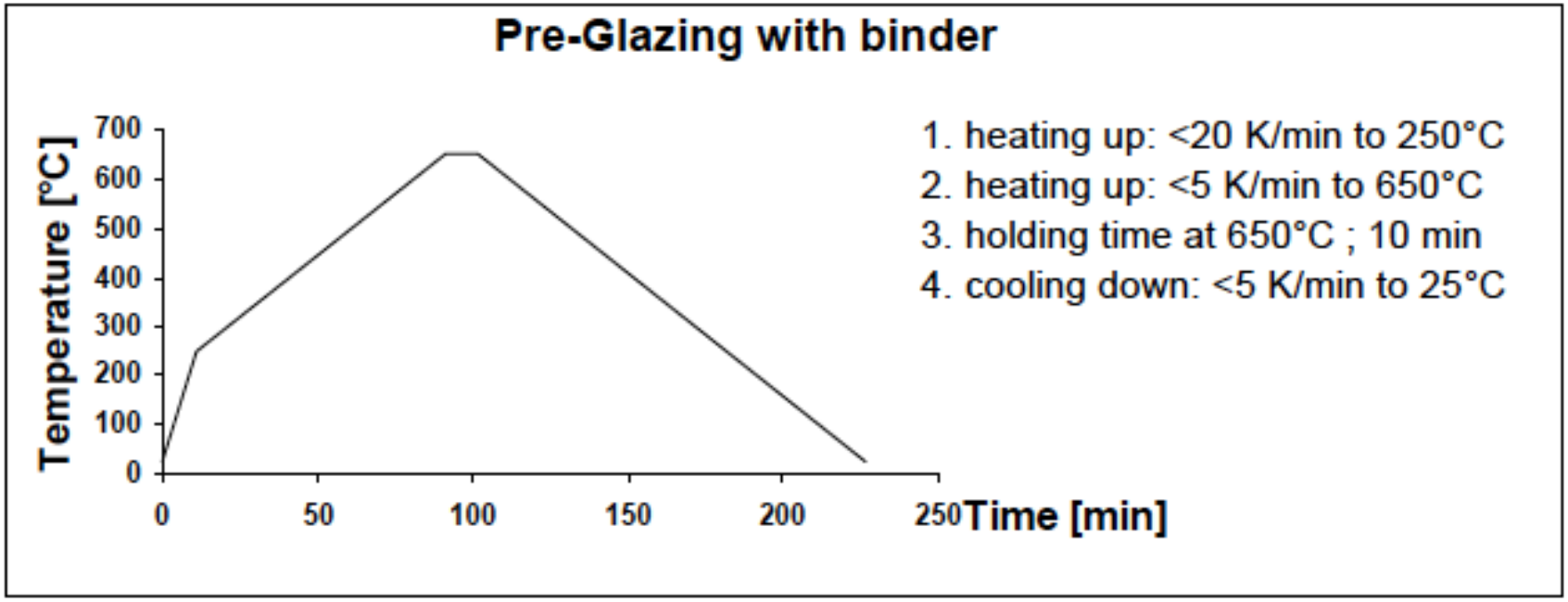
Schott Frit Data Sheet - 1
Glass # G017-002

Physical properties:
(Mean values of specified tolerance ranges)

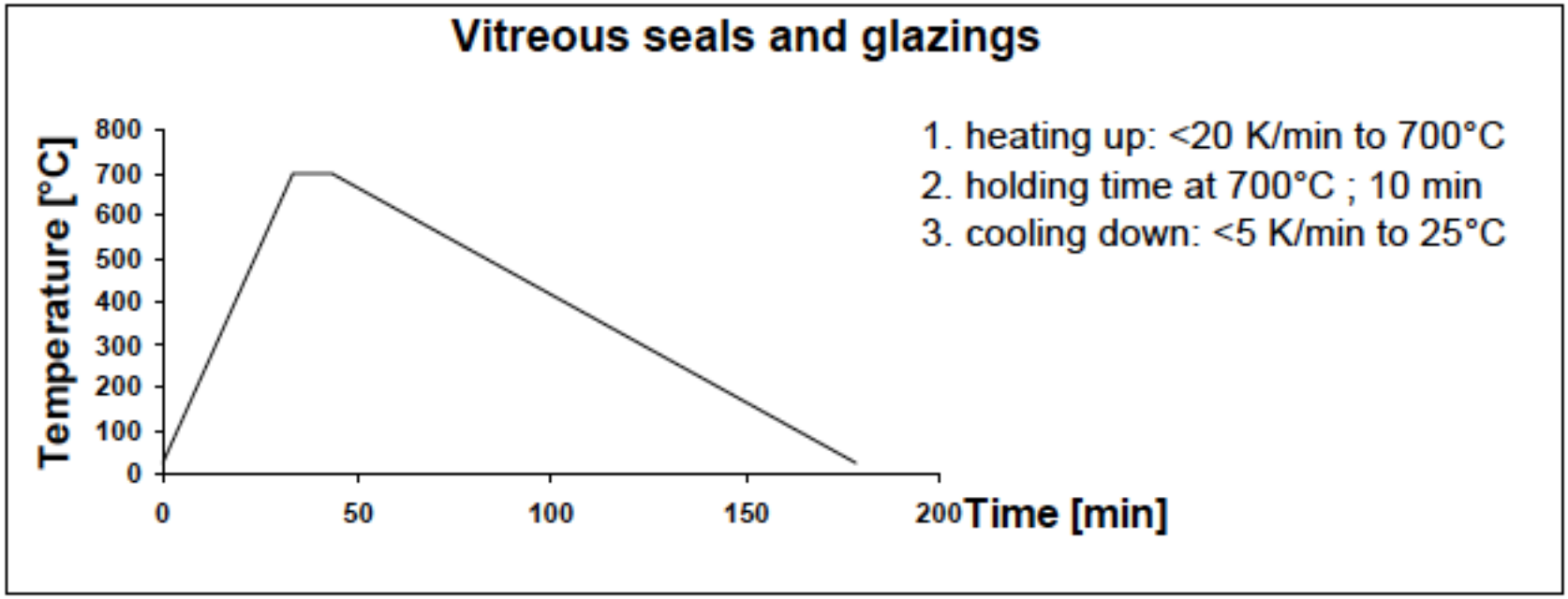
Thermal expansion coefficient (ISO 7991) α_{20-300}	3,65 $*10^{-6}$	K^{-1}
Transformation temperature (ISO 7884-8)	545	°C
Temperature for viscosity (ISO 7884-6) of $10^{7,6}$ dPas	640	°C
Density	3,25	$g*cm^{-3}$
Dielectric constant (1MHz , 25°C)	6,8	
tanδ (1MHz , 25°C)	37 $*10^{-4}$	

Form of supply:
The glass will be supplied as powder, granulate and sintered preform.

Schott Frit Data Sheet - 2
Glass # G017-002



Schott Frit Data Sheet – 3
Glass # G017-002



Schott Frit Data Sheet - 4
Glass # G017-002

Supplementary Information

Chemical Composition (wt.%)	
B_2O_3	10-50
MgO	1-10
Al_2O_3	1-10
SiO_2	10-50
ZnO	10-50
Sb_2O_3	0.1-1
CeO_2	0.1-1
PbO	1-10
Bi_2O_3	0-0.1

Schott Frit Data Sheet - 1
Glass # G017-338

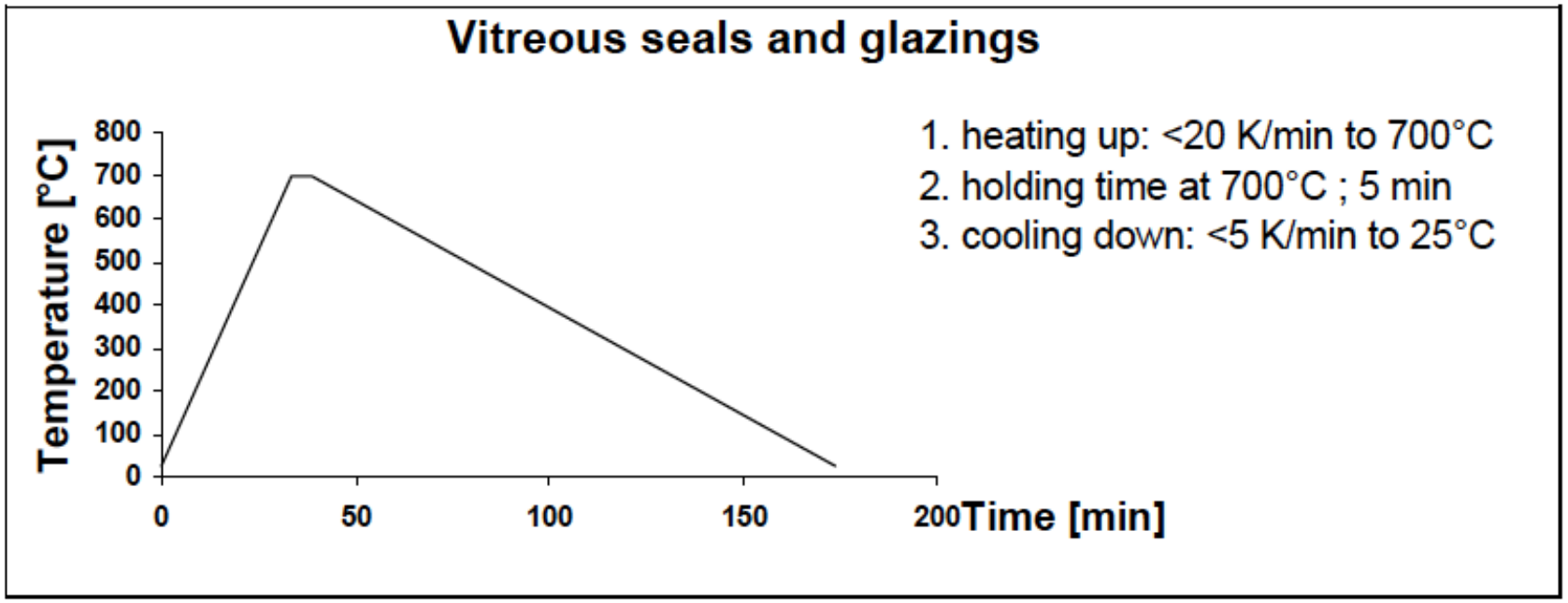
Passiviation glass for thyristors and high block rectifiers. Also usable as solder glass.

Physical properties:
(Mean values of specified tolerance ranges)

Thermal expansion coefficient (ISO 7991) α_{20-300}	$3{,}55 * 10^{-6}$	K^{-1}
Transformation temperature (ISO 7884-8)	550	°C
Density	3,4	$g*cm^{-3}$

Form of supply:
The glass will be supplied as powder.

Schott Frit Data Sheet - 2
Glass # G017-338



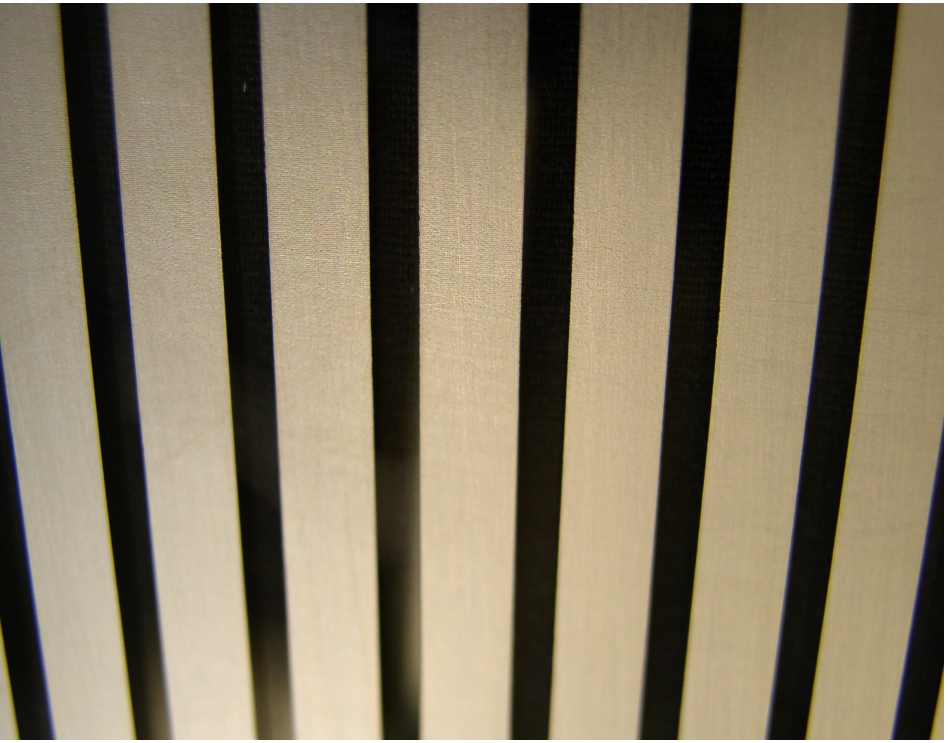
Schott Frit Data Sheet - 3
Glass # G017-338

- Supplementary information

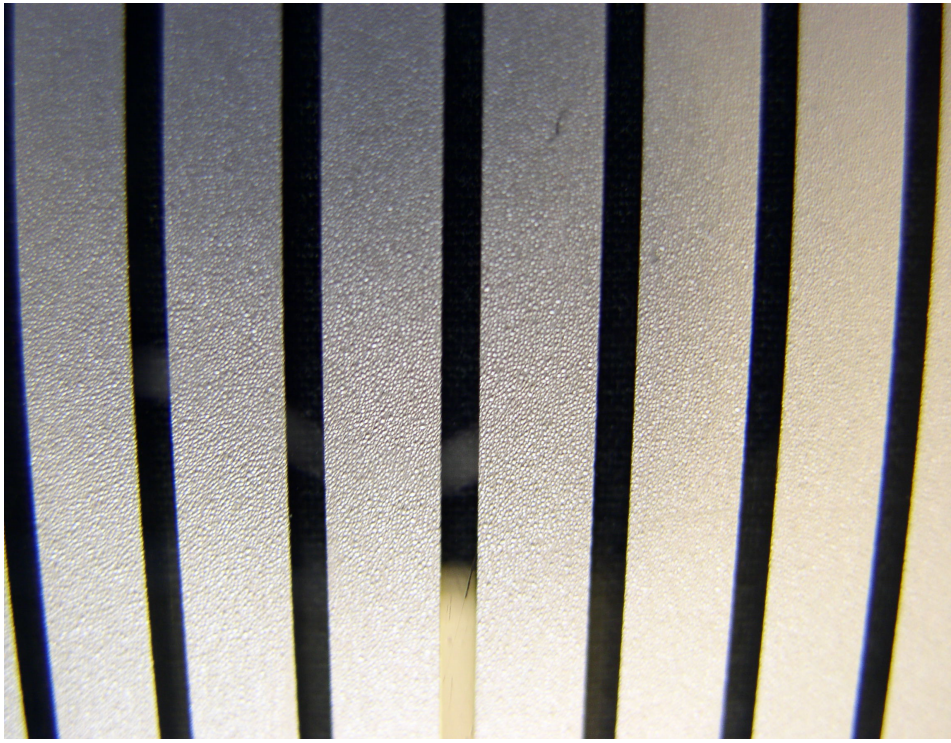
Chemical Composition (wt.%)

B_2O_3	10-50
MgO	1-10
Al_2O_3	1-10
SiO_2	10-50
ZnO	>50
Sb_2O_3	0.1-1
CeO_2	0.1-1
PbO	1-10
Bi_2O_3	0-0.1

Surface Condition with Naked Eye

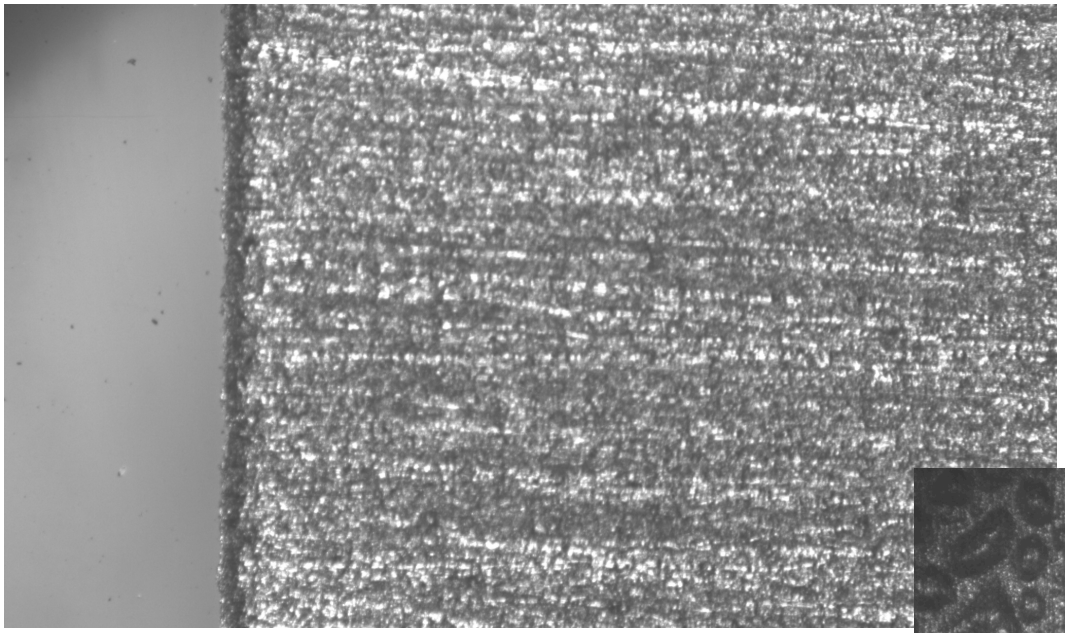


Fired at 470° C



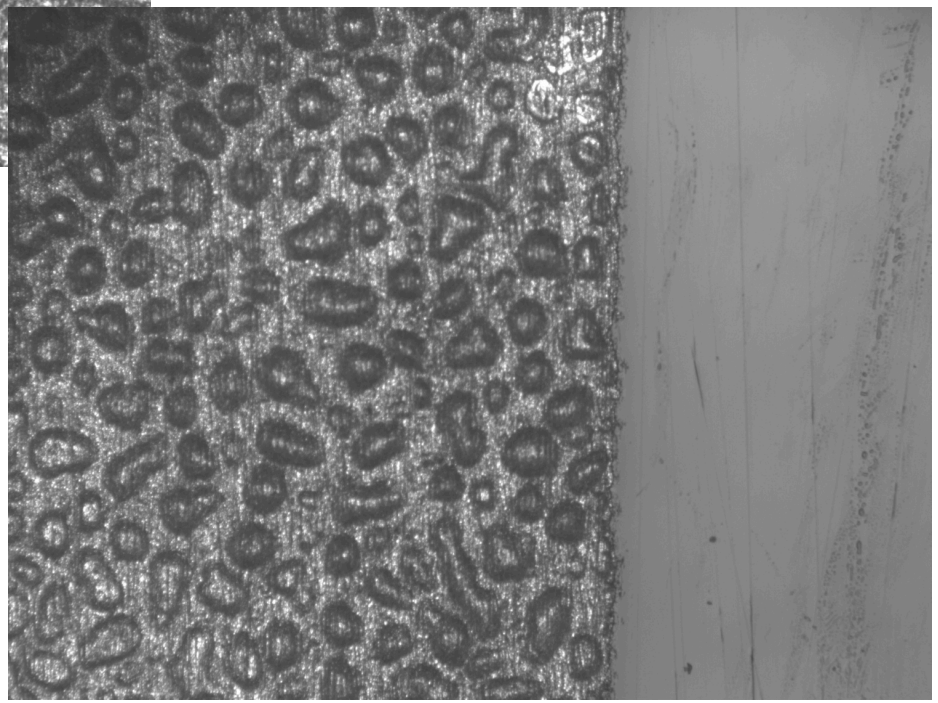
Fired at 700° C

Surface Condition with 50x Microscope



Fired at 470° C

Fired at 700° C



Completed Anode Frit Seal