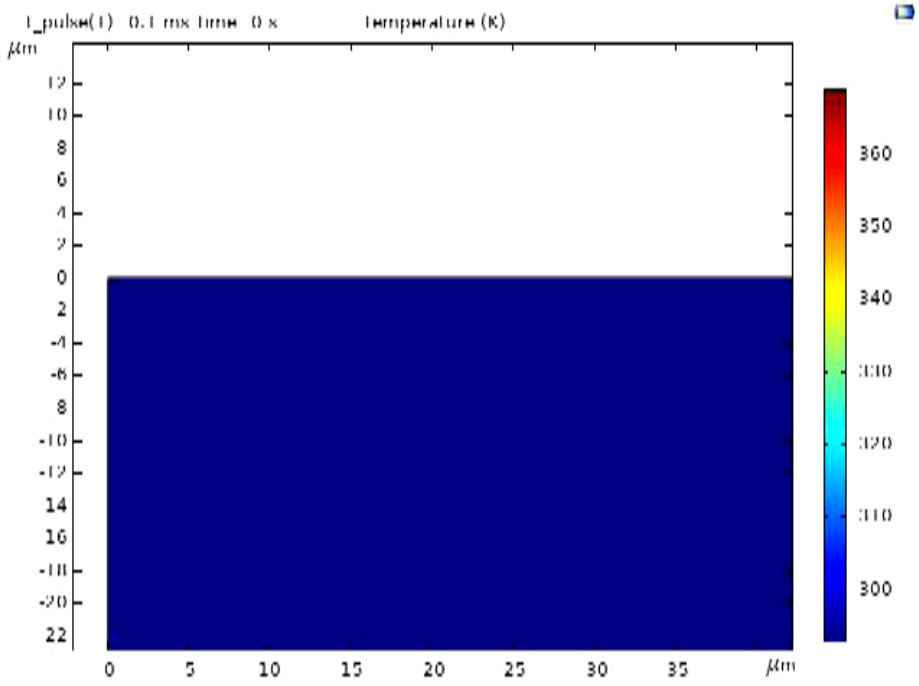
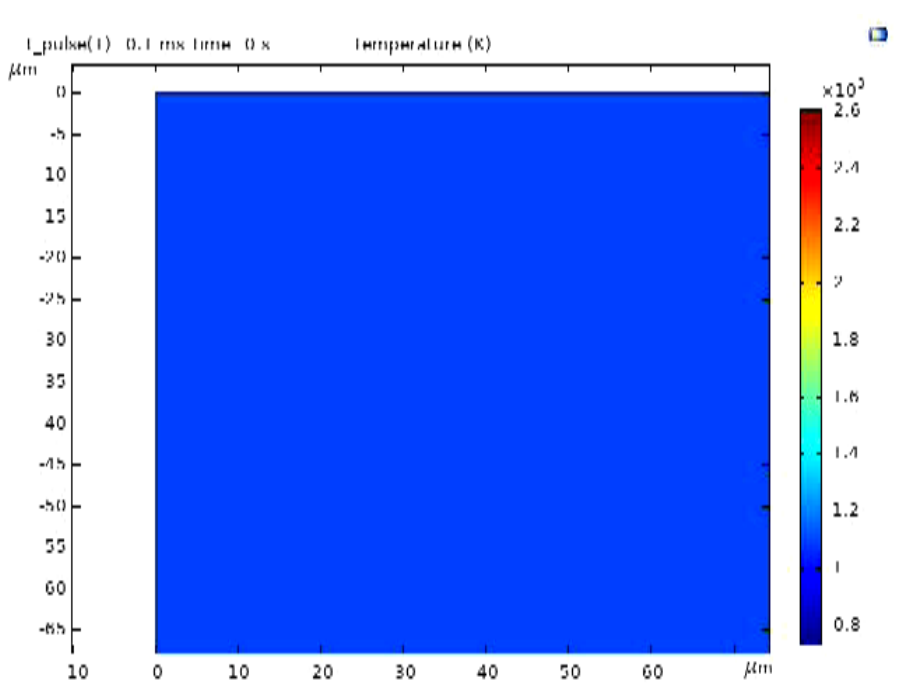
Anurag Singhania Master thesis 2020
Computational result: approach 1





Wafer at ambient temperature
0.1 ms

Preheated wafer

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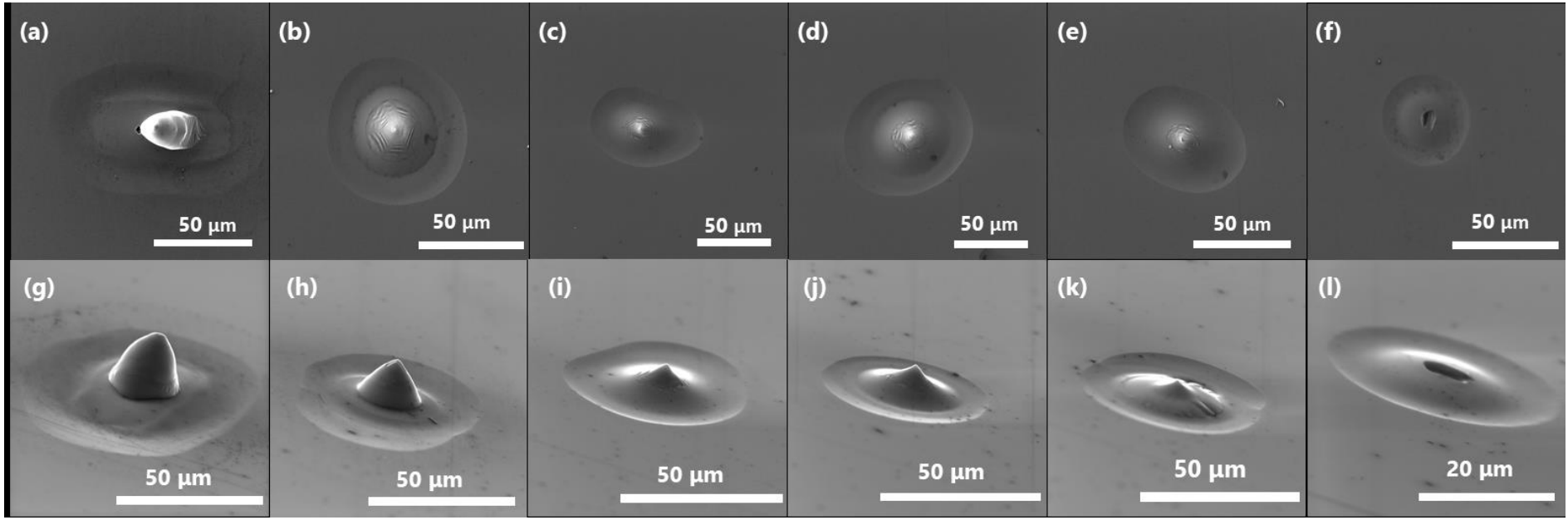
Experimental results

- 10 W, substrate preheated to 820 C, varying pulse durations

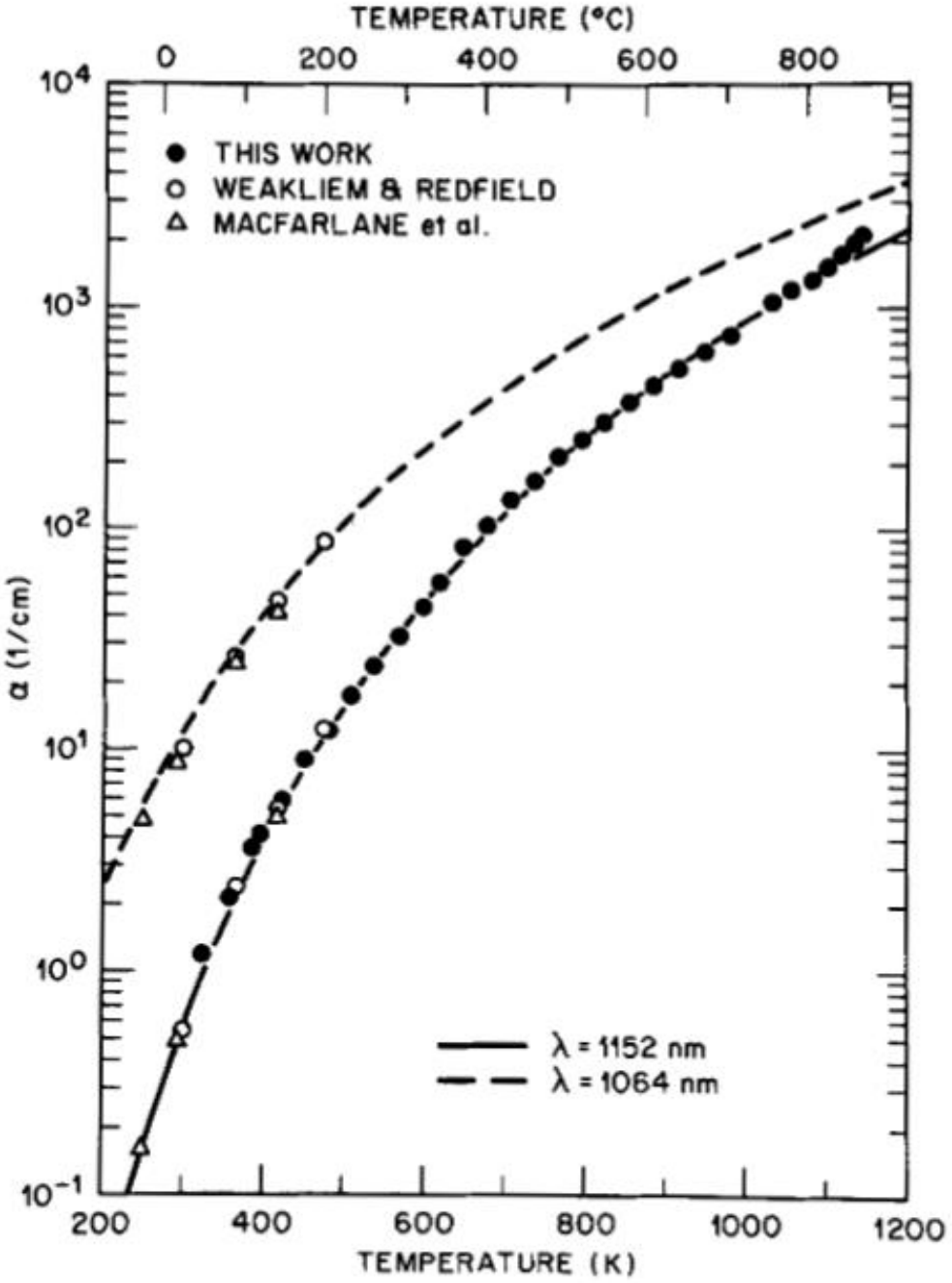


5 ms | 2 ms | 1ms | 0.75 ms | 0.5 ms | 0.25 ms

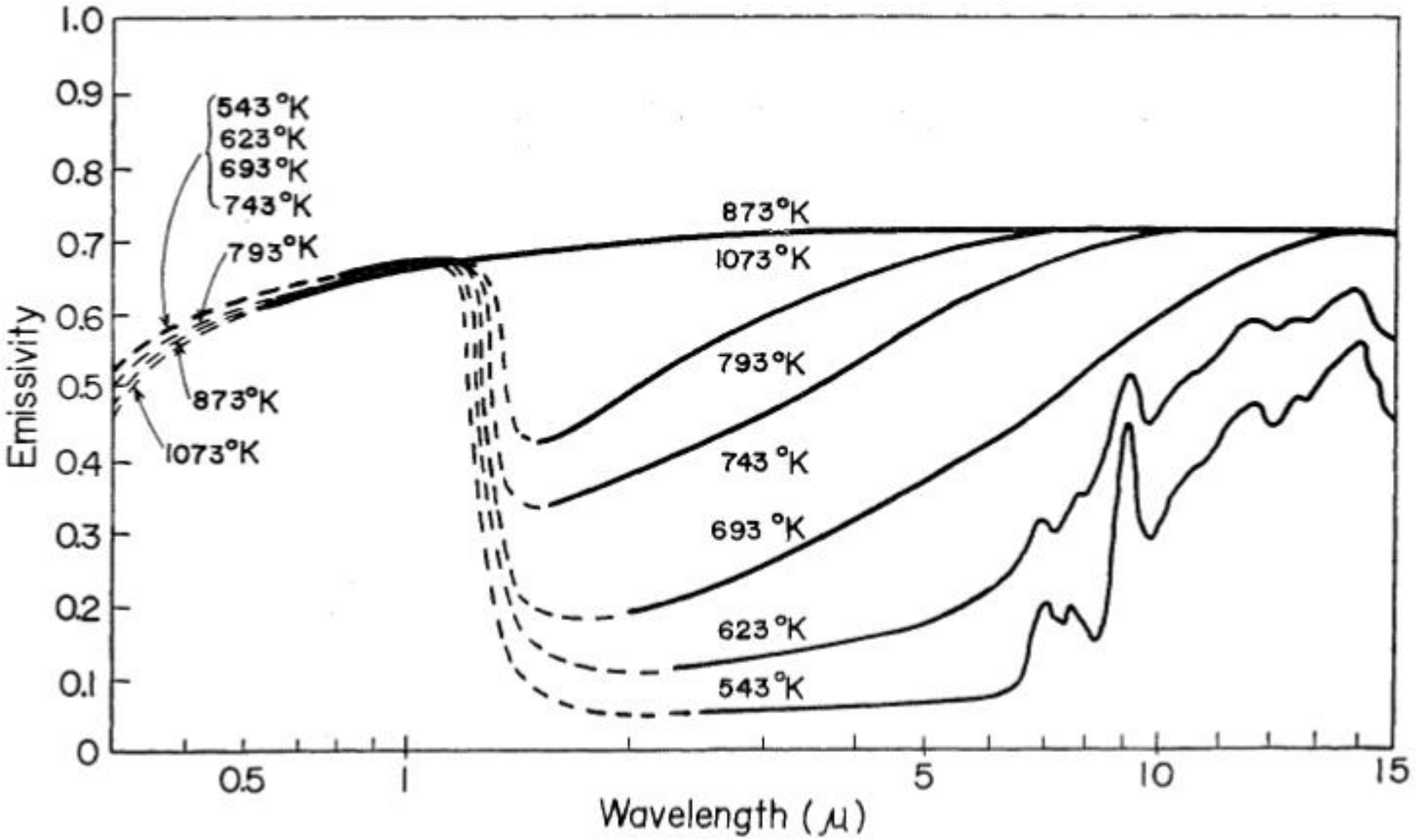
Absorption coefficient of silicon

Where is the band gab of Si ?

Why is the absorption coefficient increasing with increasing temperature?



Emissivity of silicon



Additional slides: Properties of silicon

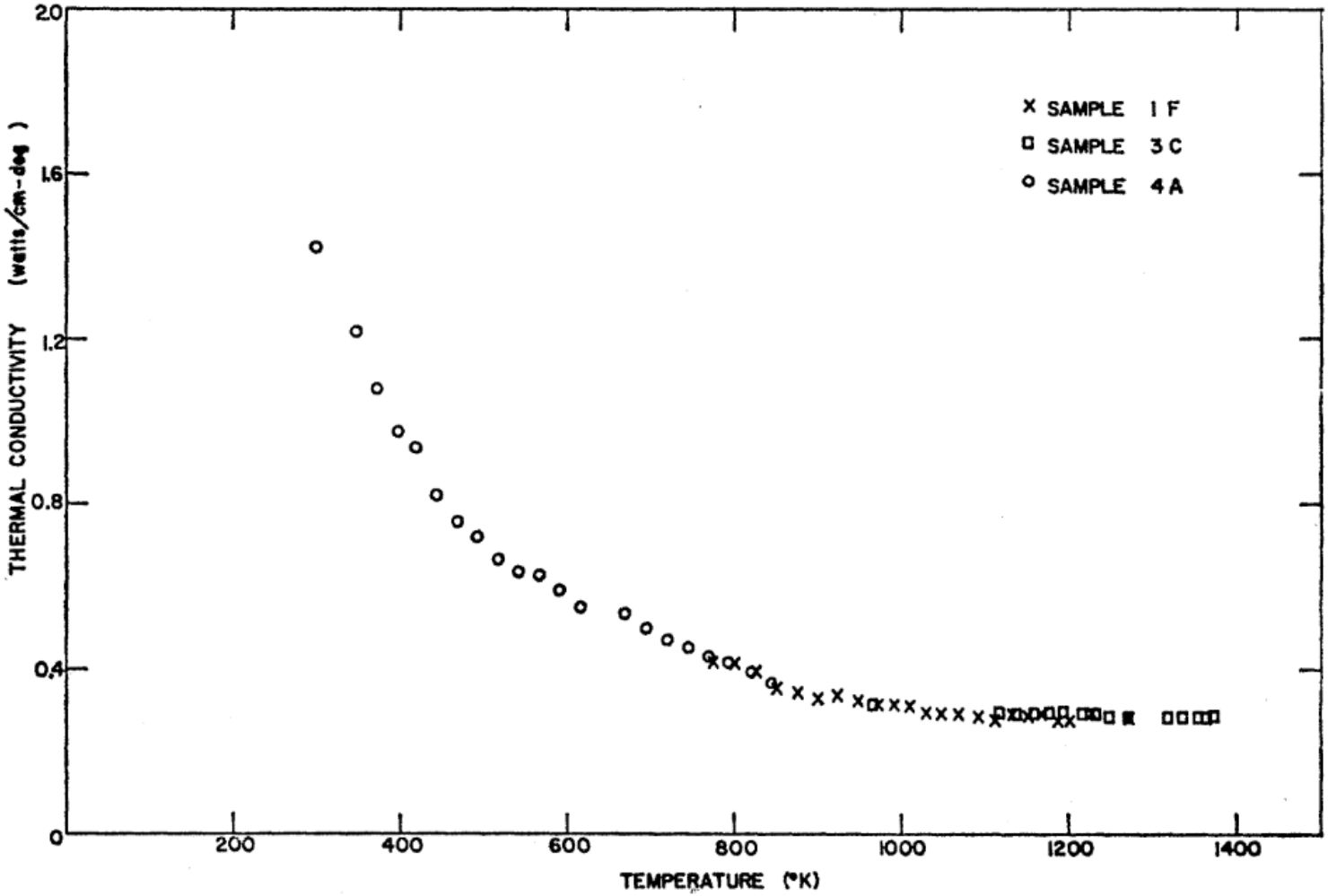


FIG. 3. Thermal conductivity of silicon from 300 to 1400°K.

Additional slides: Properties of silicon

Crystalline silicon melts at 1687 K and has an enthalpy of fusion of 50.6±1.7 kJ/mol[13]. Molten silicon has a boiling point of ~3550 K and a vaporisation enthalpy of 383±10 kJ/mol. The density of molten silicon near the melting point is higher than the density of solid silicon. While the commonly referred value of solid silicon is 2.33 g/cm³ and that of molten silicon is 2.57 g/cm³, the temperature dependence of the density of solid and liquid silicon was reported by Ohsaka et al[14] by fitting measured density values as follows:

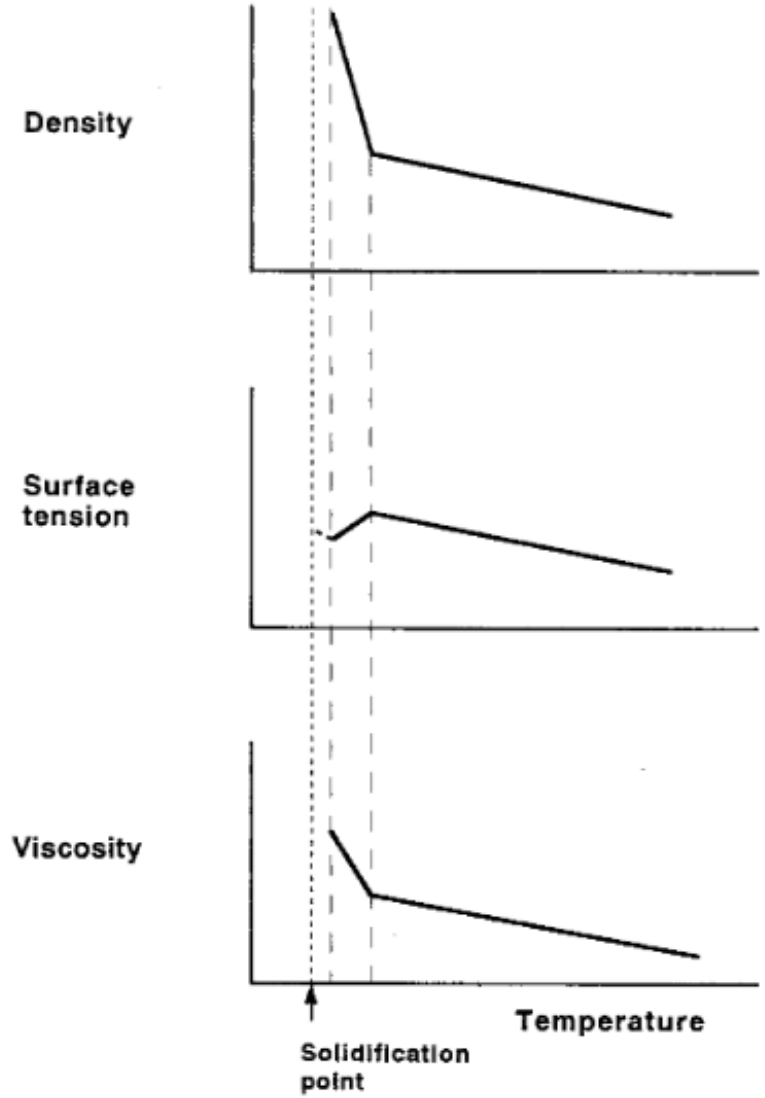
$$\rho_s(T) = \rho_s(T_m) - 2.63 * 10^{-5}(T - T_m) \left[\frac{g}{cm^3}\right] \quad , \rho_s(T_m) = 2.311\ g/cm^3 \qquad \text{Eq: 1}$$

$$\rho_l(T) = \rho_l(T_m) - 1.71 * 10^{-4}(T - T_m) - 1.61 * 10^{-7}(T - T_m)^2 \left[\frac{g}{cm^3}\right] \quad , \rho_l(T_m) = 2.580\ g/cm^3 \qquad \text{Eq: 2}$$

Table 1 Optical properties of Liquid silicon

λ	Refractive index		Absorption coefficient	Normal incidence reflectance
	n	k	α (1/cm)	R
1070 nm	4.91	7.30	$0.86*10^6$	0.777

Additional slides: Properties of silicon



. 11 Schematic temperature dependence of the basic properties of molten silicon.