Exercise 1

Exercise 2

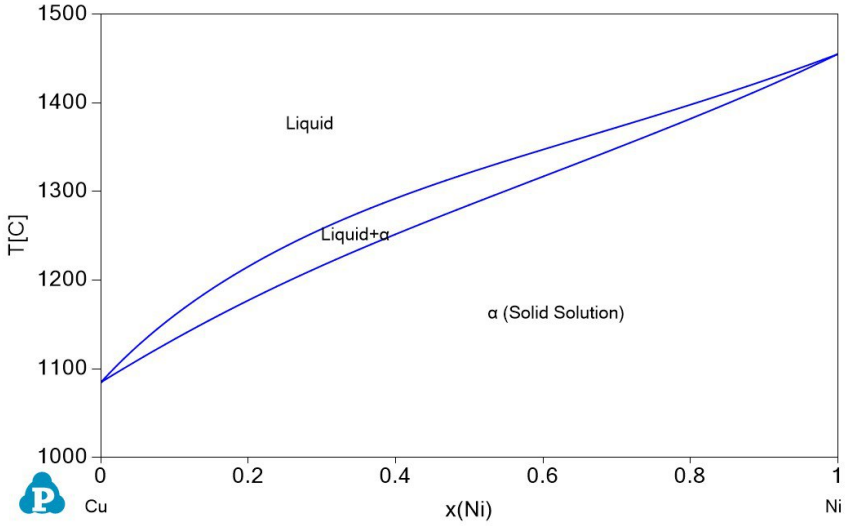

Figure 1: Phase diagram Cu-Ni

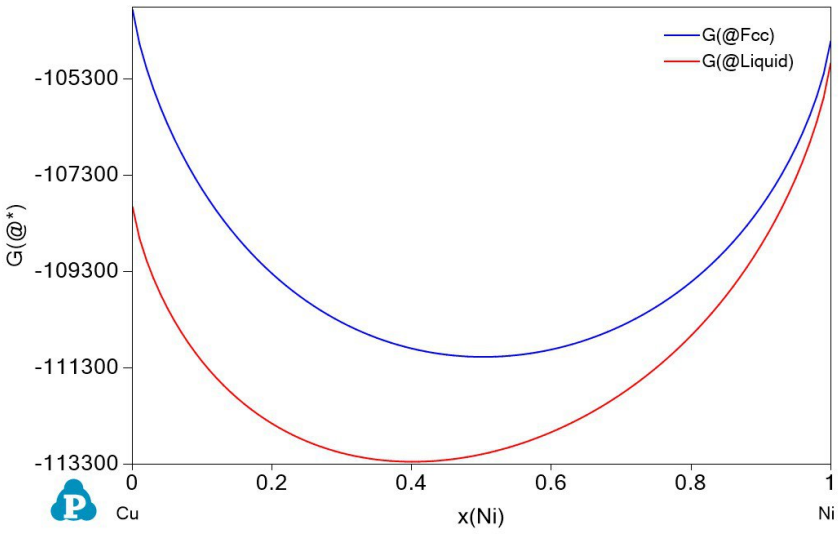

Figure 2: Energy curve @ 1500°C

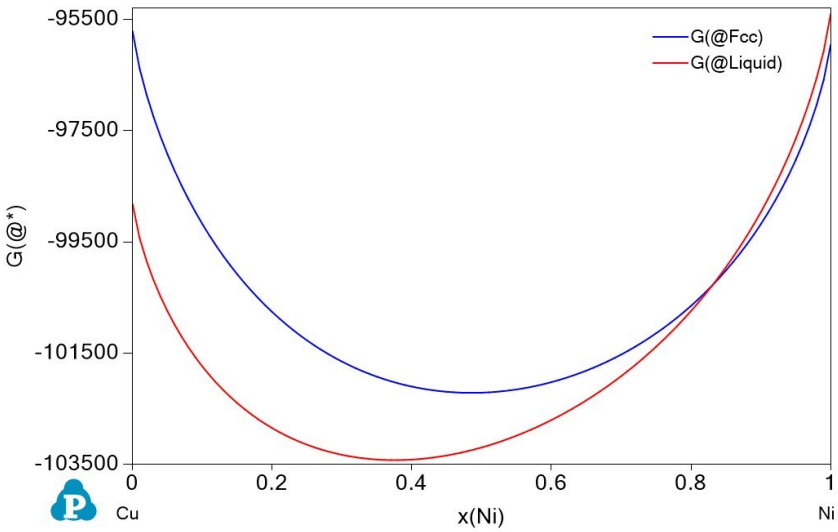

Figure 3: Energy curve @ 1400°C

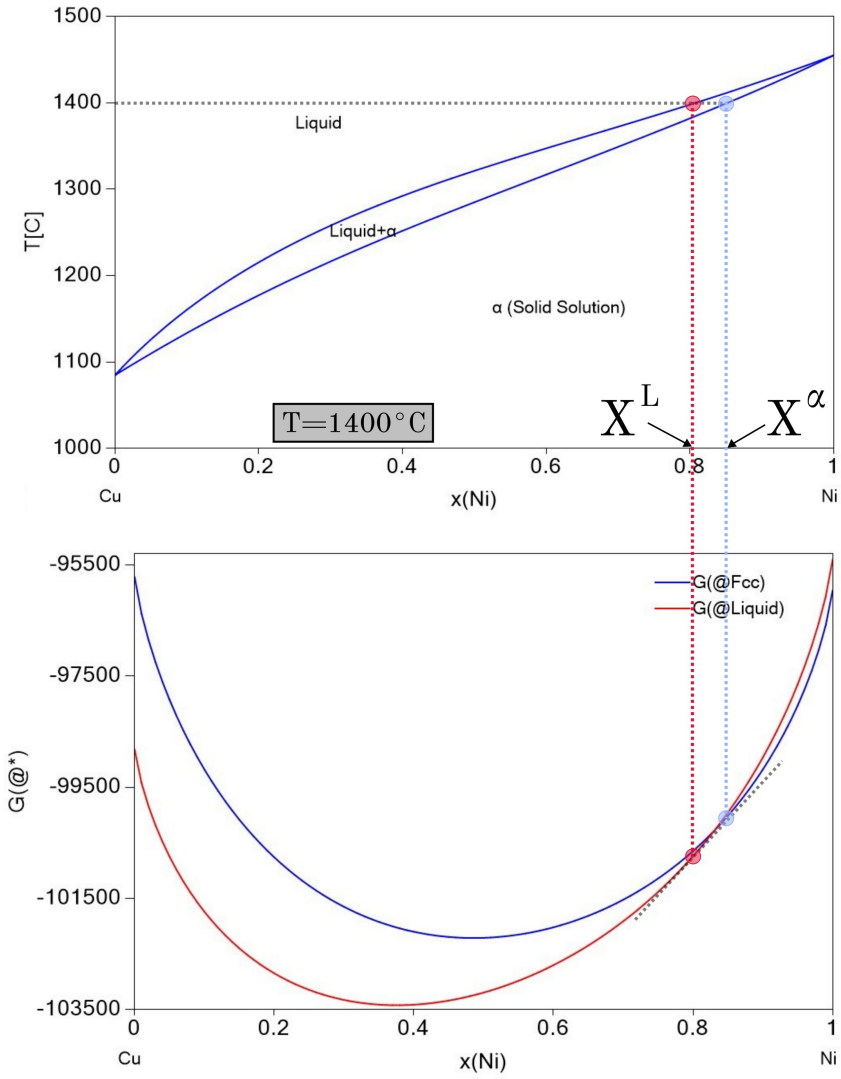

Figure 4: Tangent method @ 1400°C

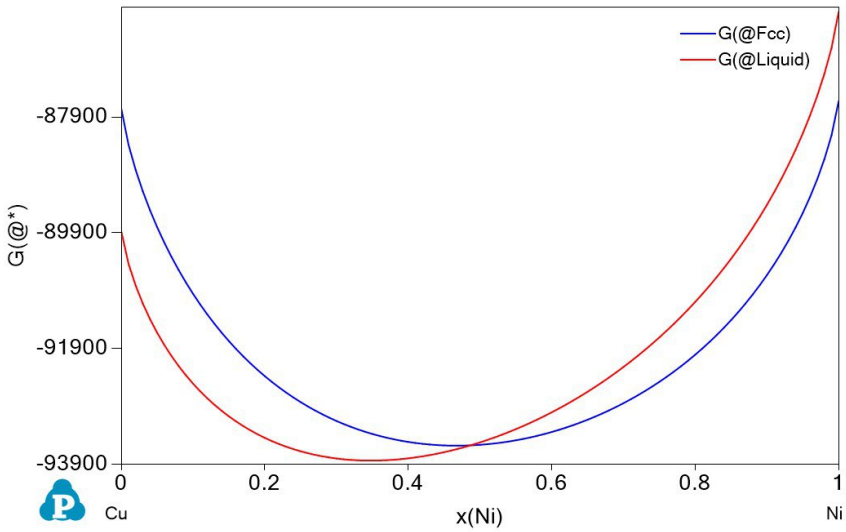

Figure 5: Energy curve @ 1300°C

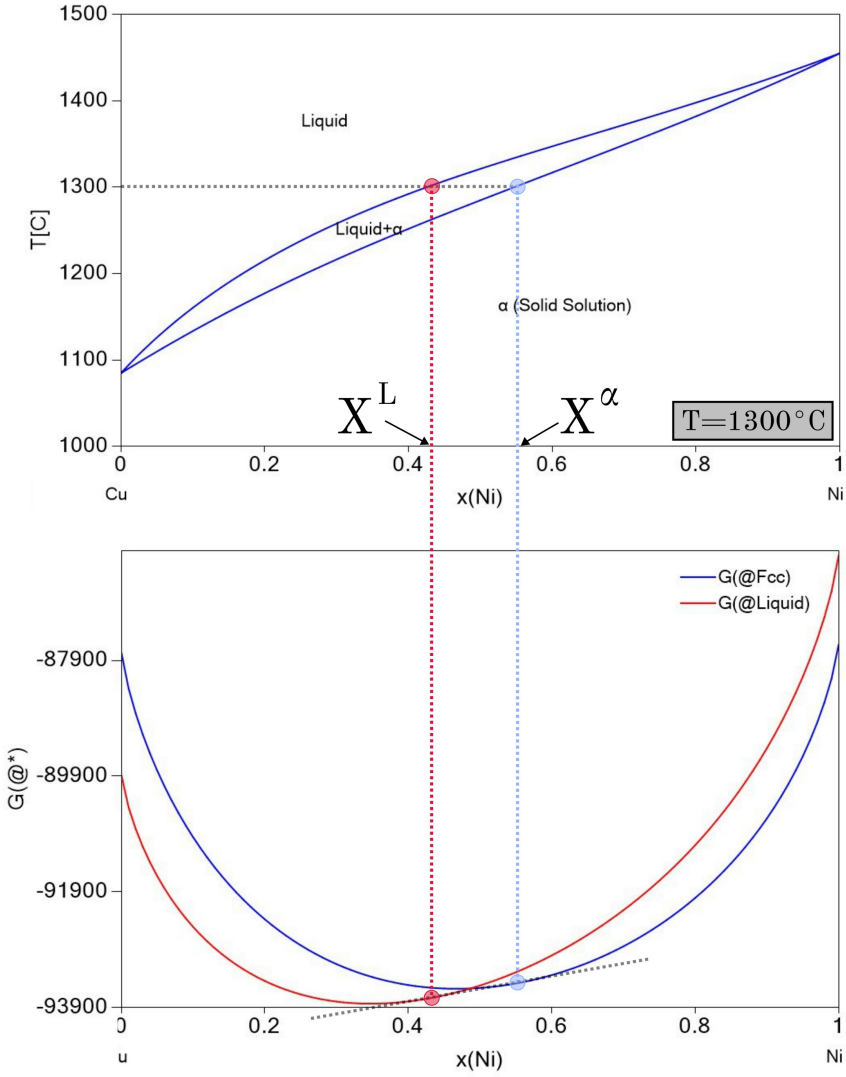

Figure 6: Tangent method @ 1300°C

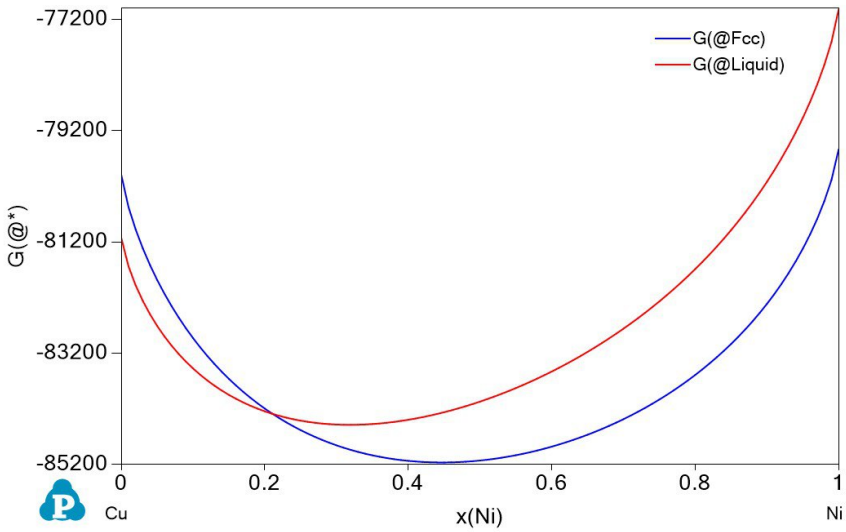

Figure 7: Energy curve @ 1200°C

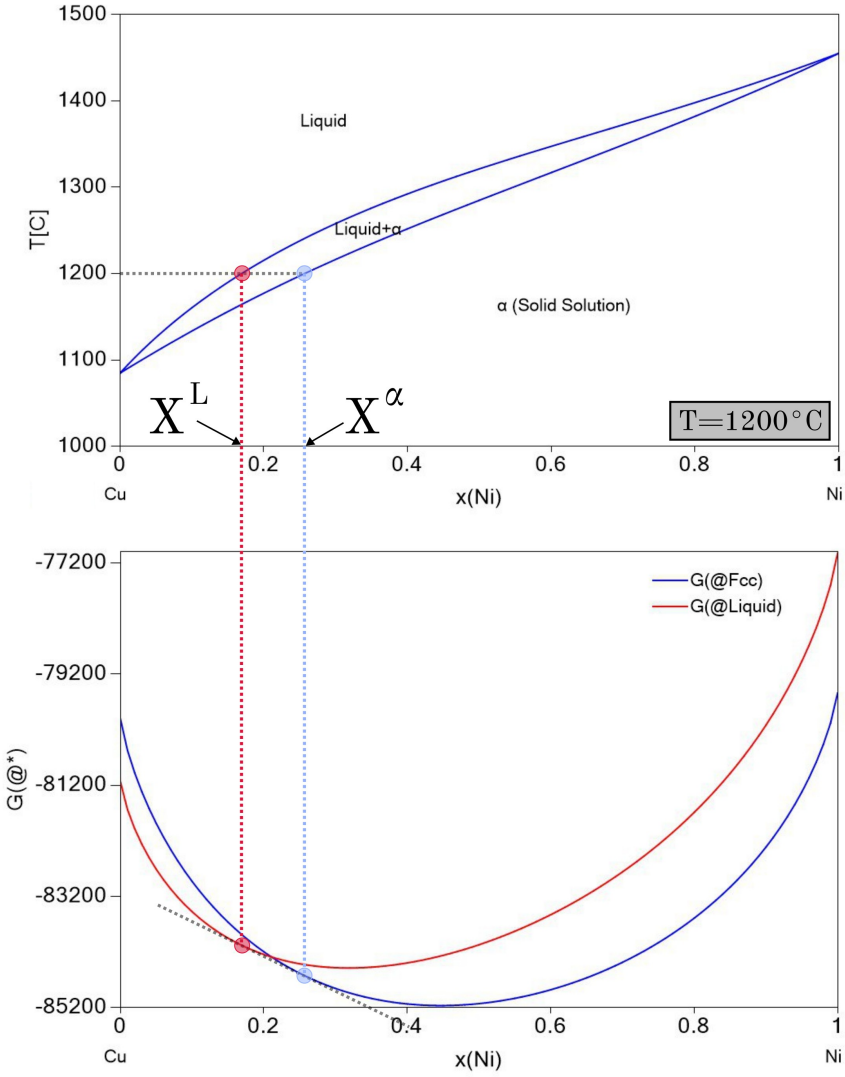

Figure 8: Tangent method @ 1200°C

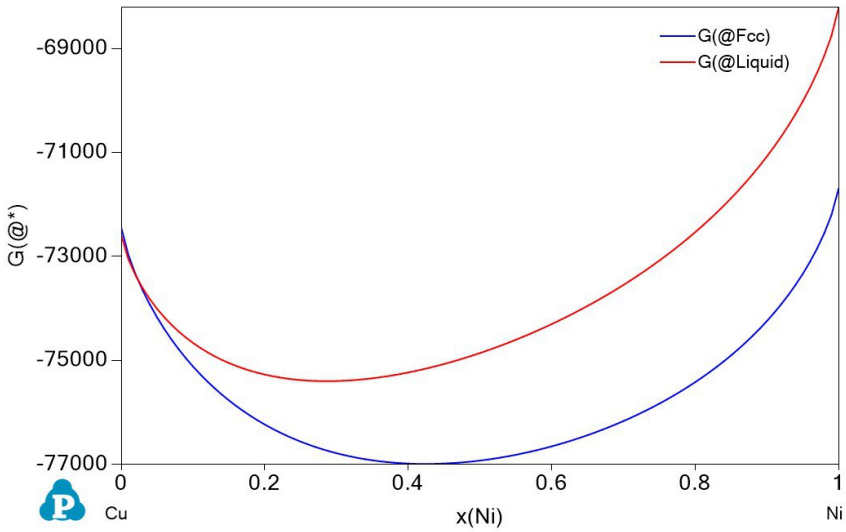

Figure 9: Energy curve @ 1100°C

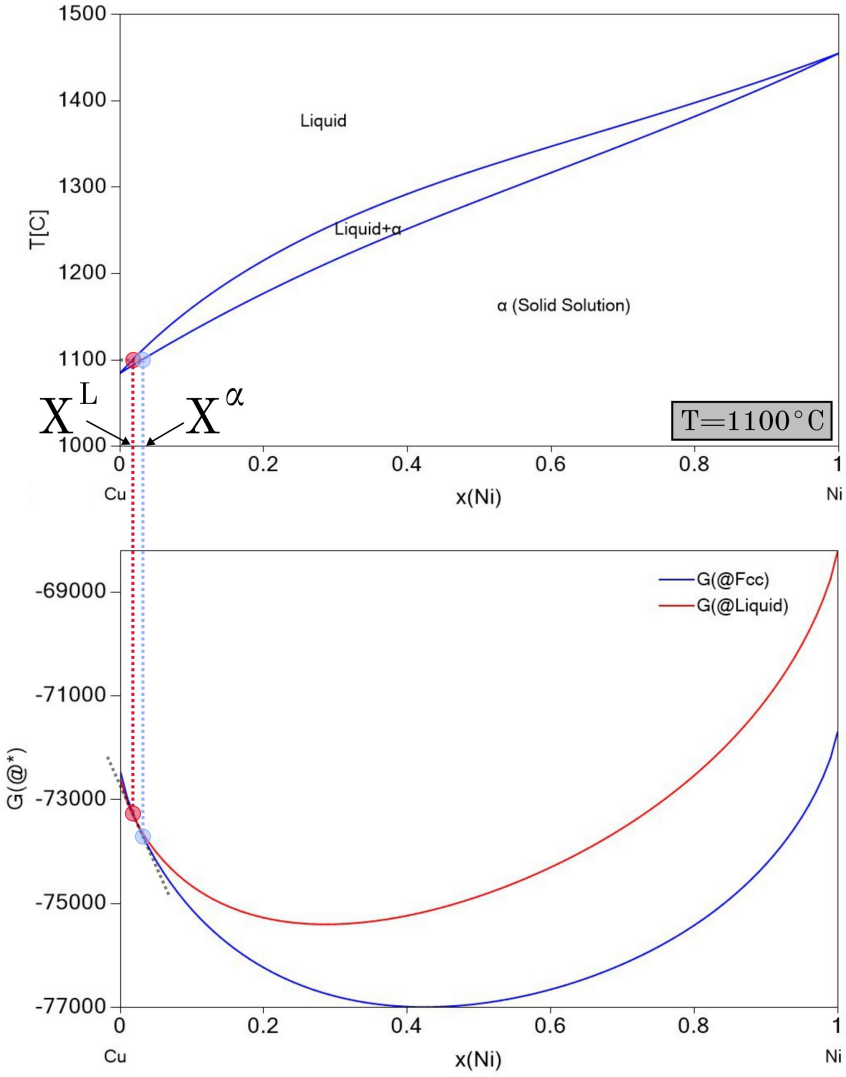

Figure 10: Tangent method @ 1100°C

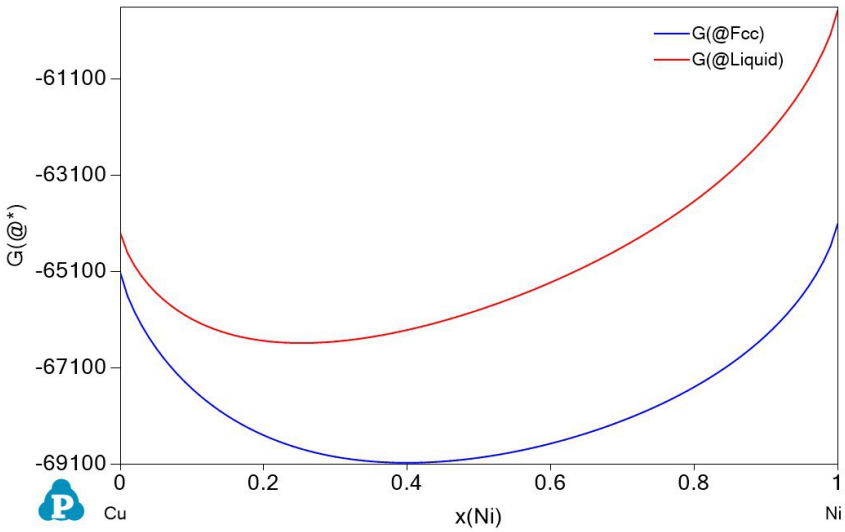

Figure 11: Energy curve @ 1000°C

Exercise 3

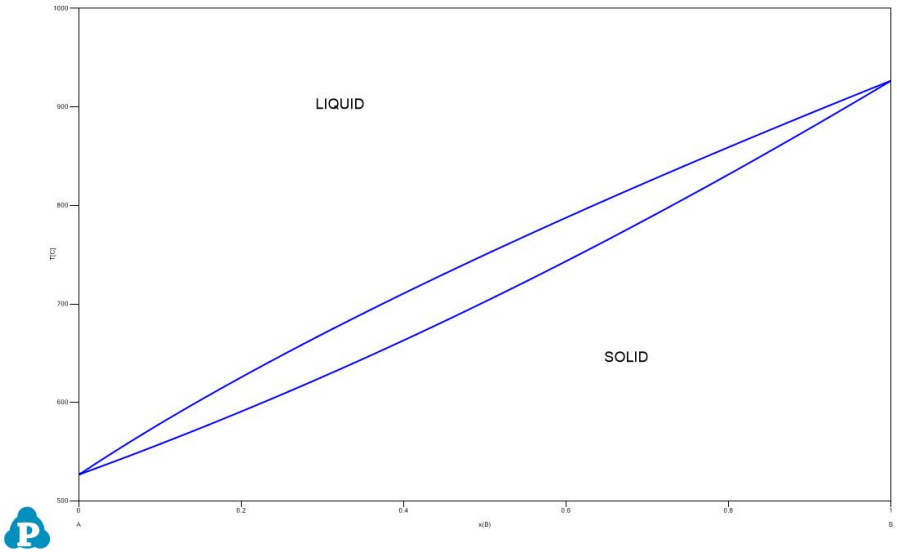

Figure 12: $\Omega_l = 0$, $\Omega_s = 0$

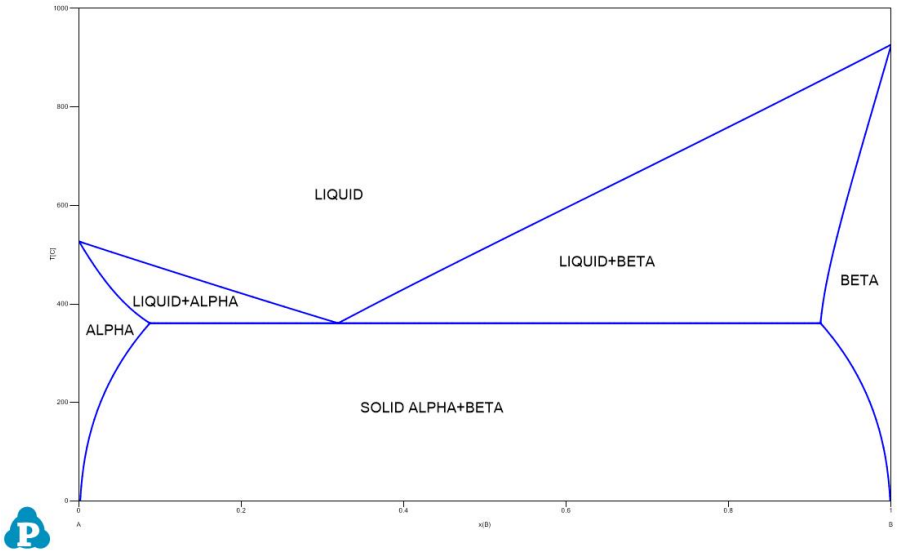

Figure 13: $\Omega_l = 0$, $\Omega_s = 15$

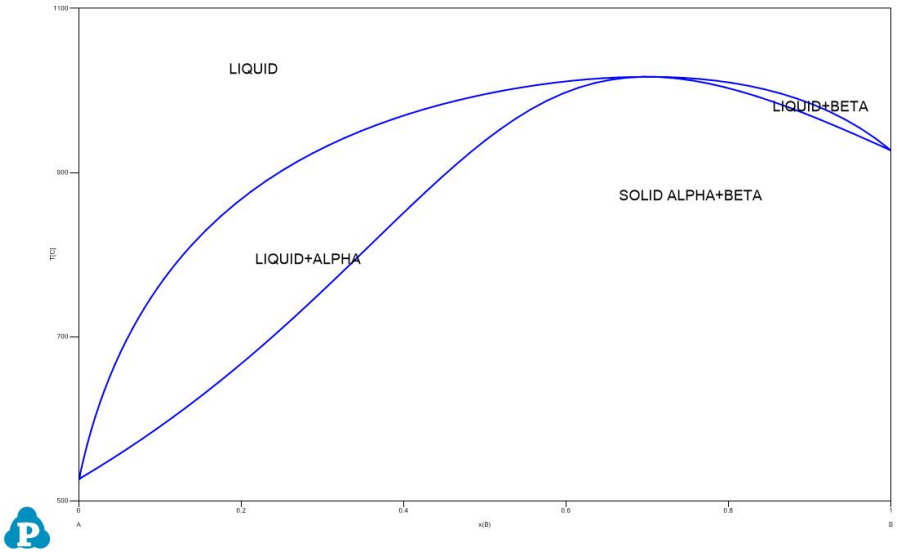

Figure 14: $\Omega_l = 10$, $\Omega_s = 0$

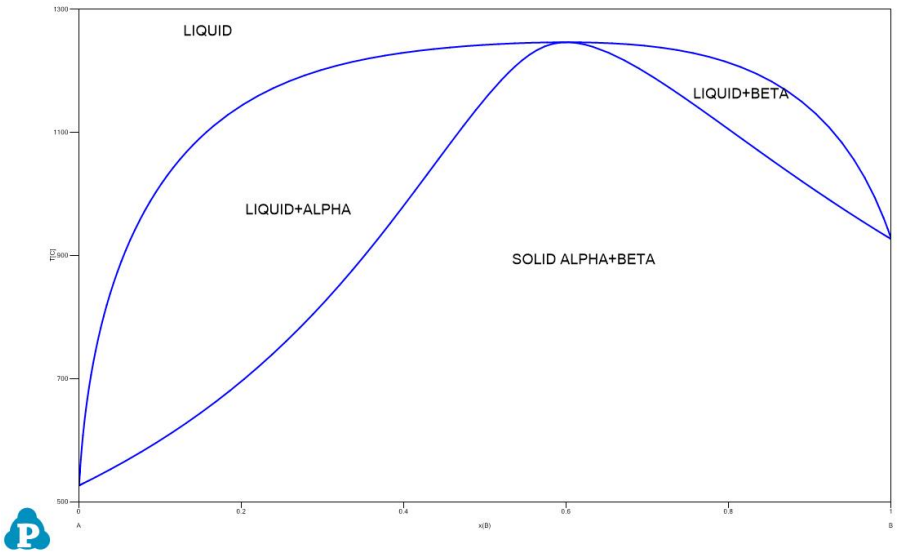

Figure 15: $\Omega_l = 20$, $\Omega_s = 0$

Exercise 4

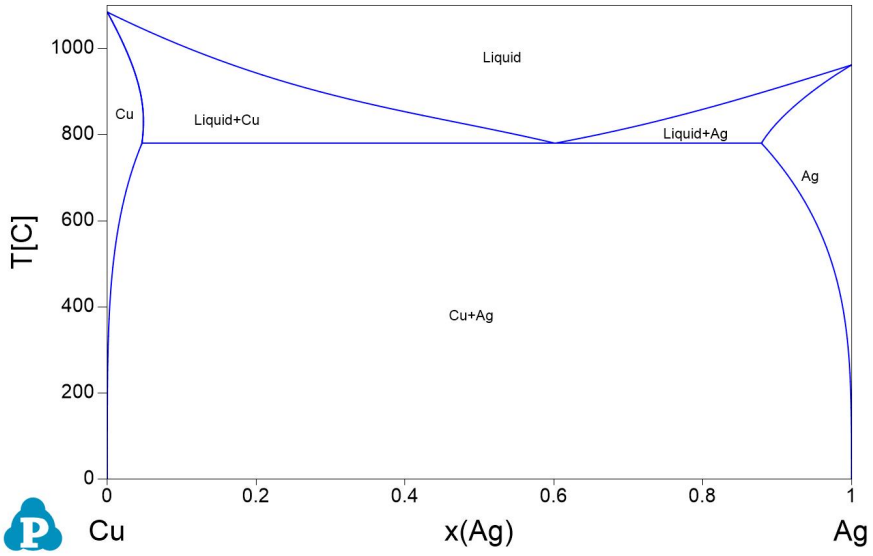

Figure 16: Phase diagram Ag-Cu

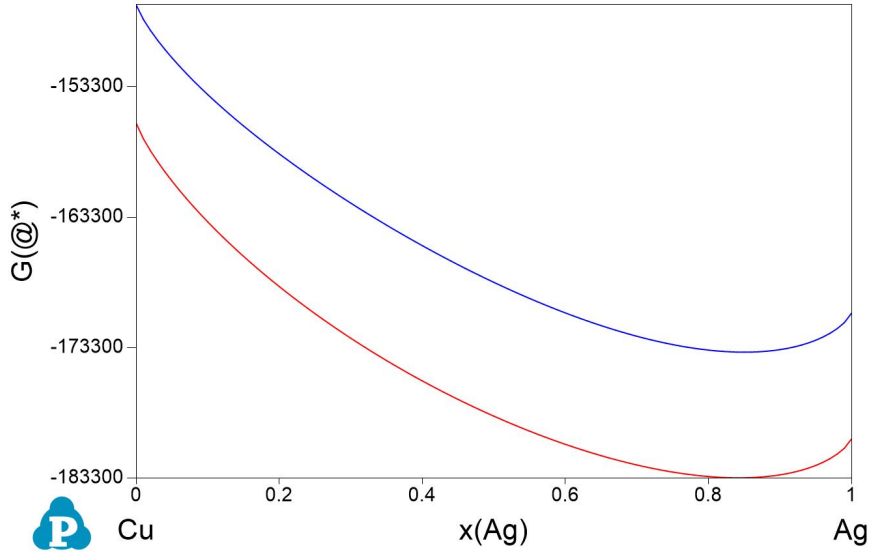

Figure 17: Energy curve @ 2000°C

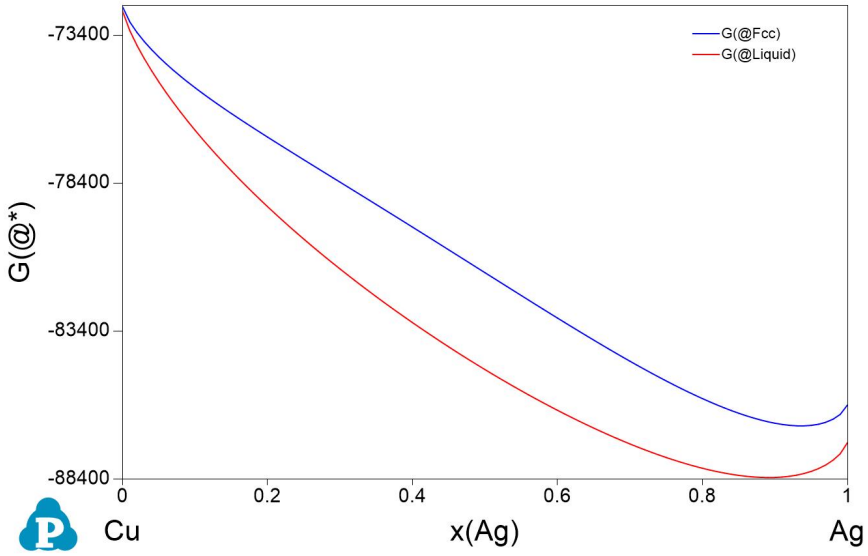

Figure 18: Energy curve @ 1100°C

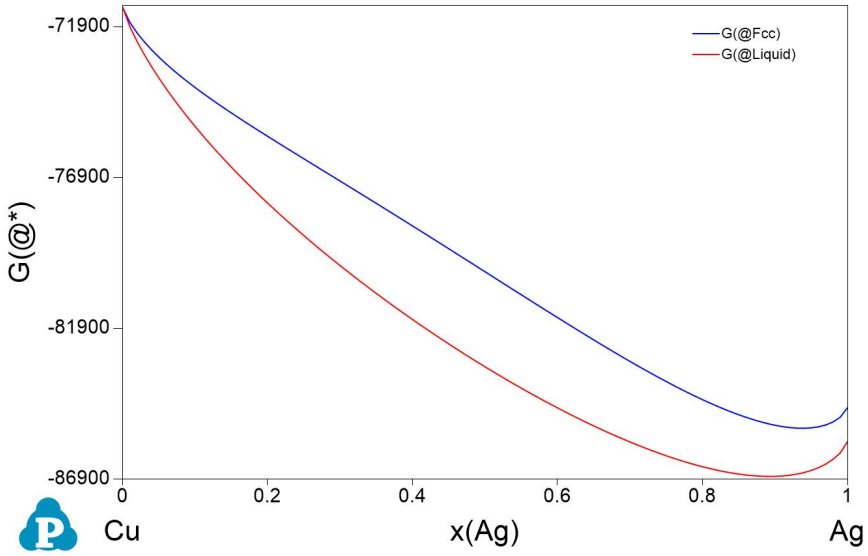

Figure 19: Energy curve @ 1084°C

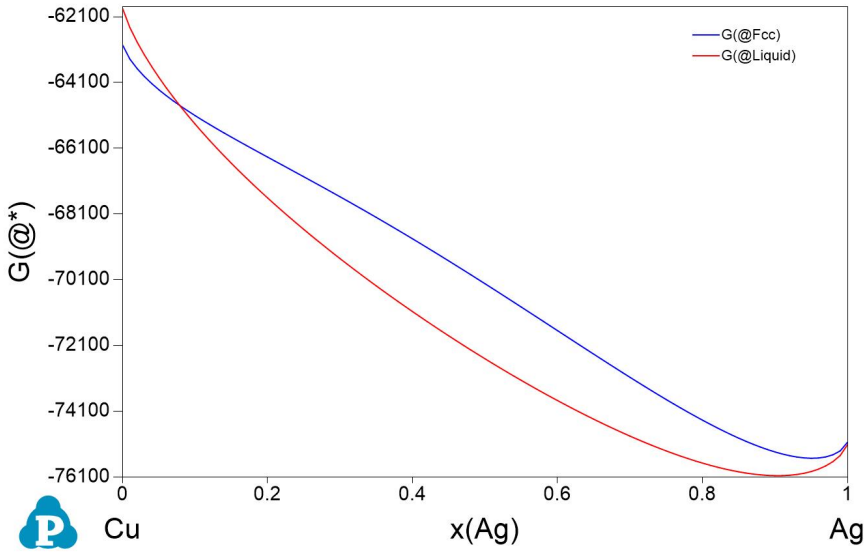

Figure 20: Energy curve @ 970°C

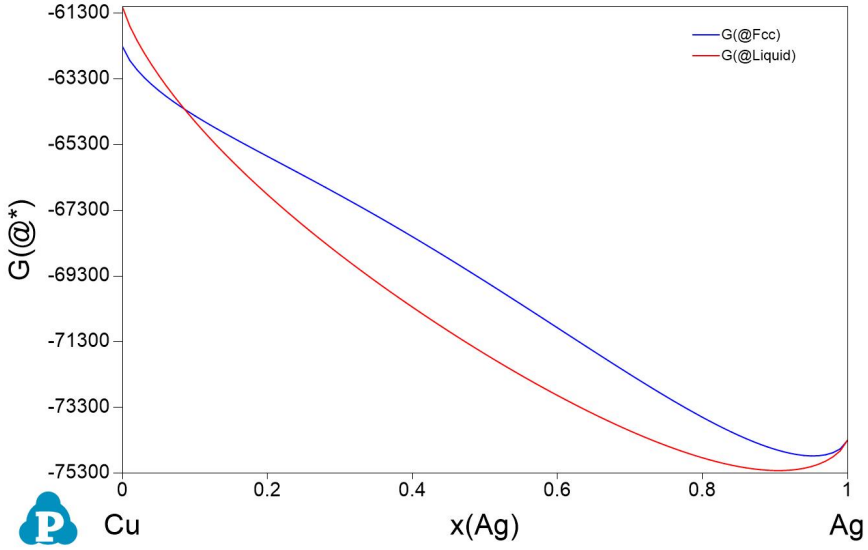

Figure 21: Energy curve @ 961°C

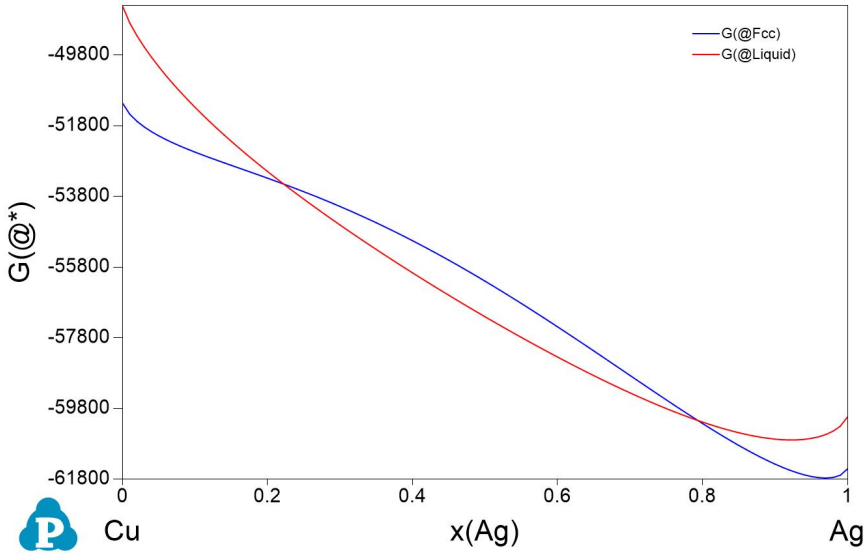

Figure 22: Energy curve @ 800°C

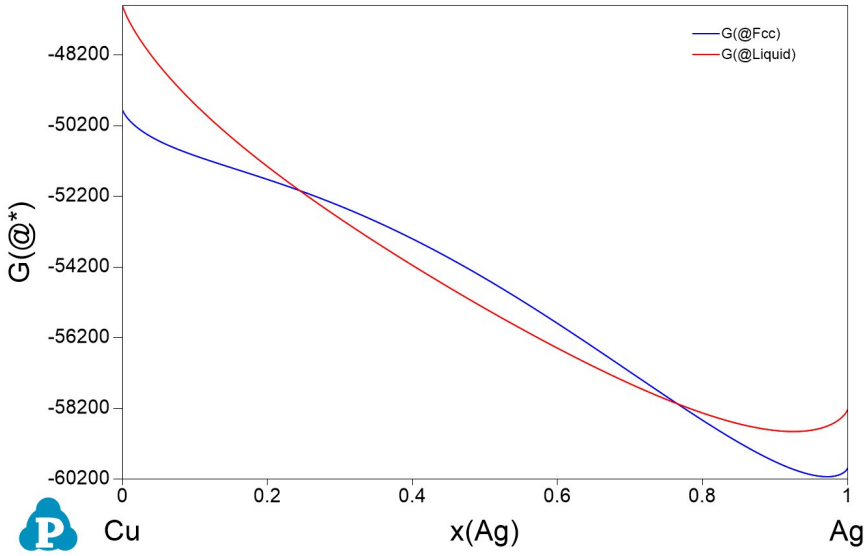

Figure 23: Energy curve @ 779°C

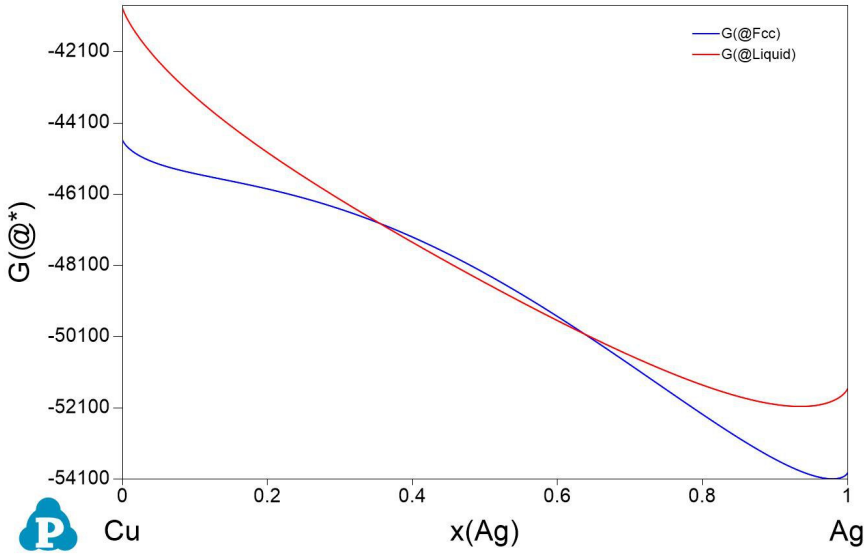

Figure 24: Energy curve @ 700°C

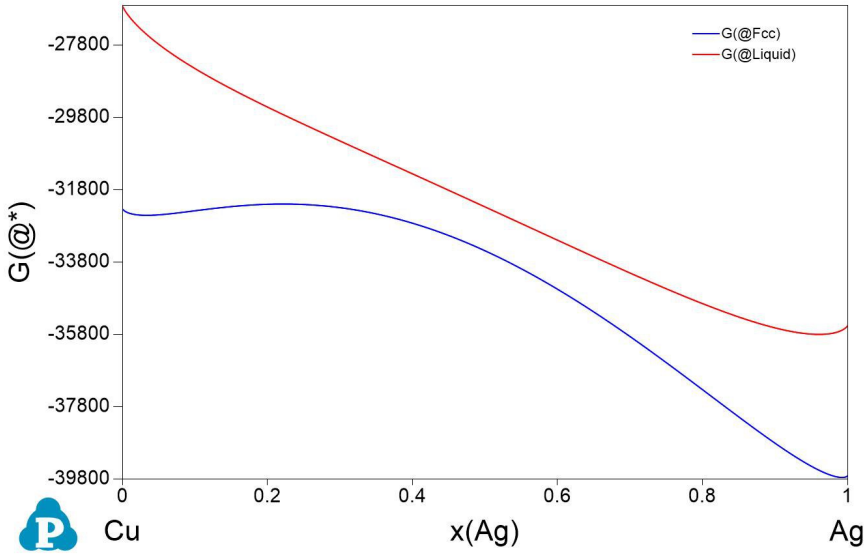

Figure 25: Energy curve @ 500°C

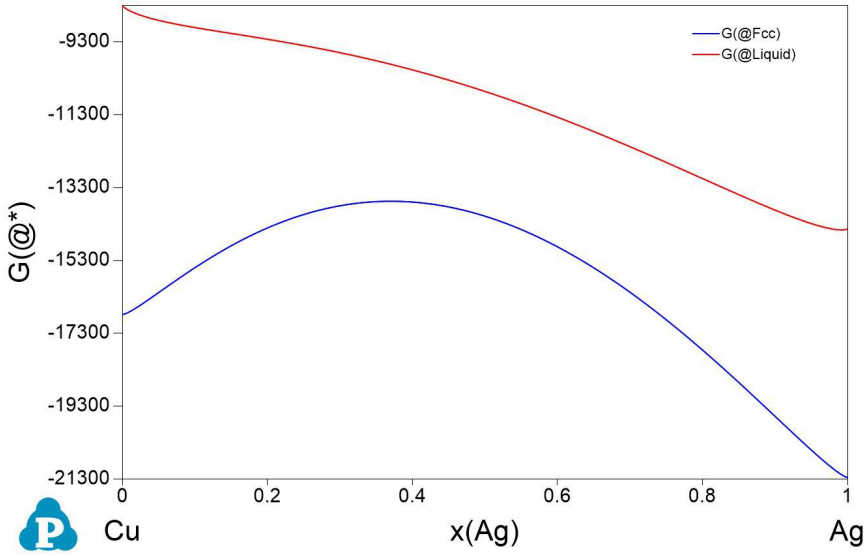

Figure 26: Energy curve @ 200°C

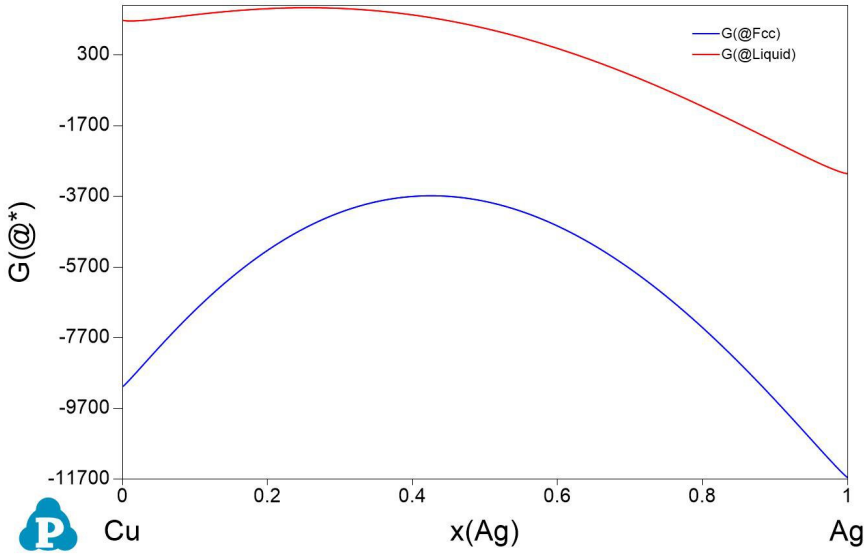

Figure 27: Energy curve @ 0°C

Exercise 5

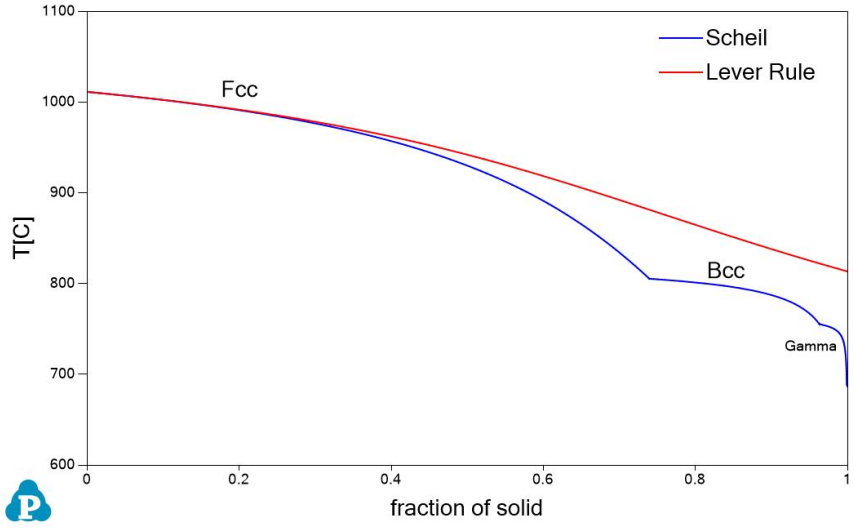

Figure 28: Solidification curves

Exercise 6

Granta LAB part

Overview: First of all we are choosing the mechanical properties that are the most intereseting for a helmet. We chose `Hardness - Vickers (HV)` and `Fracture toughness (MPa.m`$^{0.5}$`)`

Physical conditions consideration: We should take into consideration the following environment conditions when designing the product.

Property	**Value**
Temperature	20–25 °C
Energy absorption	550 kJ/m^2
Sun resistance	Yes
Rain resistance	Yes

Materials candidates: ABS (internal) and EPS (external)

Structure shape: We chose dome to simulate the shape and the interaction with the forces.

Material indeces : Let's try to minimize mass first of all, then choose two options based on cost → minimize and maximize cost, then performances, durability.