**USP-SC Assessment sheet**

1. A plain carbon steel containing 0.45 wt % C is heated to 1200 °C for 1 hour (75 micron prior austenite grain diameter) then quenched to 750 °C and held until the equilibrium mix of ferrite and austenite is achieved. The furnace was then switched off and the steel allowed to cool slowly; sketch the resulting microstructure.
2. In a second experiment the same heat treatment schedule is followed but after the hold at 750 °C, the steel was quenched in water. Sketch the resulting microstructure and calculate the MS temperature. A final experiment was carried out where the sample was held until 20 % ferrite had formed at 750 °C before water quenching. What would be the resulting structure and what is the MS temperature ?
3. Estimate the holding time needed at 750 °C to achieve 20 % ferrite.
4. How would your answers to 1, 2 and 3 change if the steel contained 1.3 wt % Mn?
5. Estimate the relative growth rates of ferrite and pearlite in a plain carbon steel at 700 °C [this will require a number of assumptions and some of the parameters to be found].
6. OPTIONAL ‘Superbainites’ achieve very high strength and toughness from the formation of nanometre–sized bainite laths in retained austenite. By considering nucleation and growth behaviour indicate how this structure is achieved and how the composition and processing would be designed. How would (a) Cr and (b) Mn additions affect the superbainitic structures?