



The phase diagram for the sucrose-water system. The starting point shown by the red dot and the arrows that follow the phase boundary indicates the freezing path of a solution containing 5 % sucrose when frozen at rates typical of a freeze-dryer ( $0.5$  to  $1^\circ\text{C min}^{-1}$ ). The alternative route shown by the vertical dotted line is the freezing path when ultra-fast cooling is provided. Then the degree of supercooling takes the product below the glass transition of the 5% w/w solution and results in no ice but a purely amorphous, glassy solid.