



**Fig. 12.5** Schematic views of microstructure and flow during directional solidification along the  $y$ -axis. In (a), solidification shrinkage occurs between times  $t$  (dashed interface) and  $t + \Delta t$  (solid line) and is compensated by liquid flow along the  $y$ -axis. Notice that the incoming flow is larger than the outgoing flow. In (b), solidification shrinkage is compensated by pore growth alone. In (c), tensile strains on the dendrites perpendicular to the growth direction add to the solidification shrinkage to induce more liquid flow.

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