



Fig. 12.22 (a) Three stages of solidification of a 200 t, 5 m high, tool steel ingot, showing the evolution of the volume fraction of solid ($g_s = 0$, light; $g_s = 1$, dark). (b) The final pipe shrinkage appearing at the top surface (in red) and the increased microporosity developing just below. The dark green region has no microporosity, whereas the yellow region corresponds to a maximum pore fraction equal to an unfed solidification shrinkage. (Courtesy of ESI group.)

Copyright 2016 EPFL Press. This figure has been reproduced from *Solidification*, by J.A. Dantzig and M. Rappaz, for instructional purposes. For other uses, please contact the authors and the EPFL Press for written permission.