11.D13 This problem asks if it is possible to temper an oil-quenched 4140 steel cylindrical shaft 50 mm (2 in.) in diameter so as to give a minimum tensile strength of 900 MPa (130,000 psi) and a minimum ductility of 20%EL. In order to solve this problem it is necessary to use Figures 11.20(a) and 11.20(c), which plot, respectively, tensile strength and ductility versus tempering temperature. For the 50 mm diameter line of Figure 11.20(a), tempering temperatures less than about 590°C are required to give a tensile strength of at least 900 MPa. Furthermore, from Figure 11.20(c), for the 50 mm diameter line, tempering temperatures greater than about 600°C will give ductilities greater than 20%EL. Hence, it *is not possible* to temper this alloy to produce the stipulated minimum tensile strength and ductility. To meet the tensile strength minimum, T(tempering) < 590°C, whereas for ductility minimum, T(tempering) > 600°C; thus, there is no overlap of these tempering temperature ranges.