14.1.4 Theoretical Basis – Ternary and Quaternary Phase Diagrams

Figure 14.2 shows a three-dimensional representation of a three component (ternary) system, A, B and C, which gives an indication of the complexity brought to a phase diagram upon addition of another species.

Each new salt introduces an additional dimension to the phase diagram. At constant pressure, the phase diagram becomes three dimensional with composition on the sides of the basal triangle and temperature on the vertical axis. The region above the three concave surfaces represents an undersaturated solution while the surfaces, crossed with isotherms in Figure 14.2, represent the saturation values at different temperatures. The surfaces are separated by boundary curves which represent a series of pseudo-binary eutectic conditions where two solid phases on either side of the curves are at equilibrium with the liquid of the composition determined by the temperature. The concentration of the third component, in aqueous solution, increases along these curves and the curves converge on the ternary eutectic point.

At the ternary eutectic point, all three solid phases, A, B and C, are in equilibrium with a liquid solution containing constituents of the three solids. Ternary phase diagrams can be constructed by considering either the

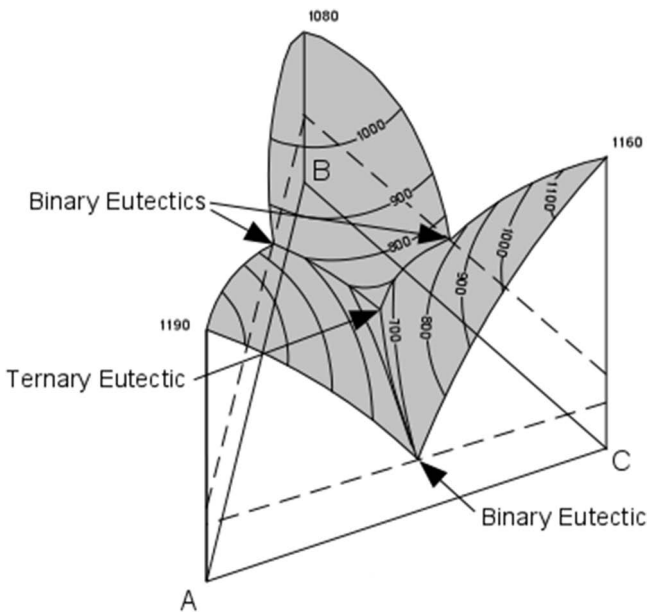

Figure 14.2 3D ternary phase diagram. Reproduced from ref. 13 with permission from Professor Stephen A. Nelson.