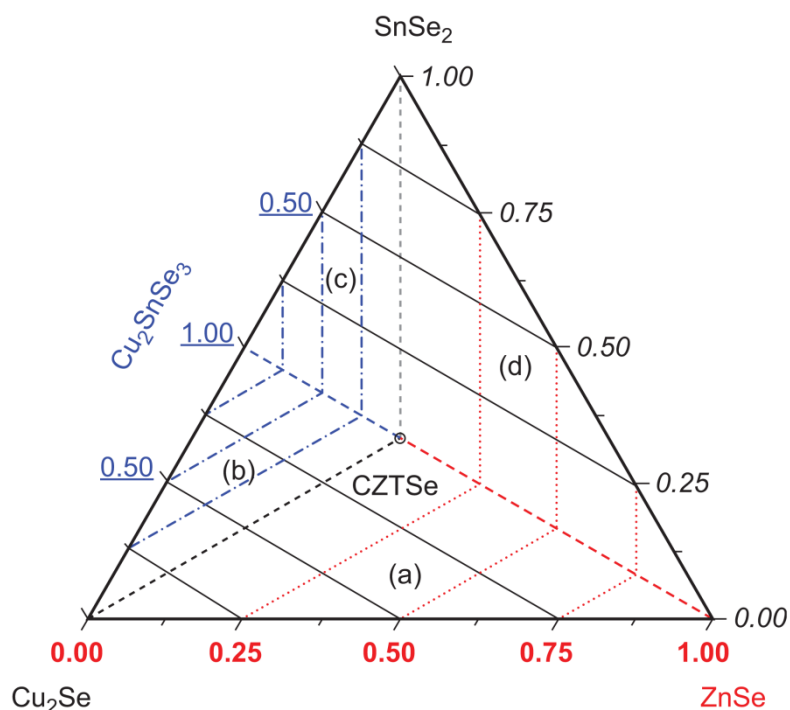


Figure 5.3 is available in colour for the readers of the print copy:



**Figure 5.3** Triangular plot showing an alternative way of displaying the phase composition in the  $\text{Cu}_2\text{Se}$ - $\text{ZnSe}$ - $\text{SnSe}_2$  pseudo-ternary system, based on the explicit application of the lever rule to CZTSe,  $\text{Cu}_2\text{Se}$  (black),  $\text{SnSe}_2$  (italic type),  $\text{ZnSe}$  (bold type) and  $\text{Cu}_2\text{SnSe}_3$  (underlined). The dashed lines represent the pseudobinary joints (tie lines)  $\text{Cu}_2\text{Se}$ -CZTSe (black),  $\text{SnSe}_2$ -CZTSe (grey),  $\text{ZnSe}$ -CZTSe (dotted lines) and  $\text{Cu}_2\text{SnSe}_3$ -CZTSe (dot-dash lines). Samples with composition falling on these joints are biphasic with CZTSe + one secondary phase, and the mole fraction can be read on the correspondingly coloured scale (solid lines are a guide to the eye). Samples with composition falling in each of the four triangles defined by the dashed lines are triphasic. These are respectively: CZTSe +  $\text{Cu}_2\text{Se}$  +  $\text{ZnSe}$  (a), CZTSe +  $\text{Cu}_2\text{Se}$  +  $\text{Cu}_2\text{SnSe}_3$  (b), CZTSe +  $\text{Cu}_2\text{SnSe}_3$  +  $\text{SnSe}_2$  (c), and CZTSe +  $\text{SnSe}_2$  +  $\text{ZnSe}$  (d). Note that the occurrence of  $\text{SnSe}_2$  secondary phase depends strongly on the partial pressure of Se present during the synthesis and the cooling stages (see text). (Graph adapted with kind permission from Rabie Djemour.)