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Tetrahedral plot diagram: A geometrical solution for quaternary systems

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Abstract

The transformation from a tetrahedral four-component system to an XYZ-orthogonal coordinate axis system has been solved using the geometry of a tetrahedron. If a four component mixing ratio is described as t, l, r, and f (here, $t + l + r + f = 1$), the transforming equations can be written as

$$x = (r + 1 - l)/2$$

$$y = \frac{\sqrt{3}}{2}t + \frac{\sqrt{3}}{6}f$$

and

$$z = \frac{\sqrt{6}}{3}f$$

A tetrahedral plot diagram can be easily constructed using the algorithms described in this paper. We present an implementation of these algorithms in a custom-designed Microsoft Excel spreadsheet, including adjustable viewing angles for the tetrahedral plot. This will be of general utility for petrological or mineralogical studies of quaternary systems.

Keywords: Tetrahedral diagram, triangular diagram, quaternary systems, phase diagram, three-dimension, trilinear coordinates, tetrahedron