JPEDAV (2008) 29:213–215
DOI: 10.1007/s11669-008-9308-x
1547-7037 ©ASM International

Editorial

On the Gibbs Triangle

Having dealt with a large number of Gibbs composition triangles in my review work of ternary phase diagrams for 25 years, it may be worthwhile now to share some of my experiences with the readers of this column.

The Gibbs composition triangle is an *equilateral triangle* used for plotting ternary phase relationships at a constant temperature. The simple rules for reading and plotting compositions are well known. The rules remain simple, as long as the triangle is equilateral! In the early years of my reviewing career, occasionally I had to grapple with the problem of averaging errors arising from inaccurate triangles with sides differing from each other by a few percent. This situation was mainly due to the poor quality of the drafting facility then available to these authors.

With the increasing use of computers for plotting drawings from calculated and experimental data, this problem has largely disappeared. While accurate triangles are being drawn now in most cases,

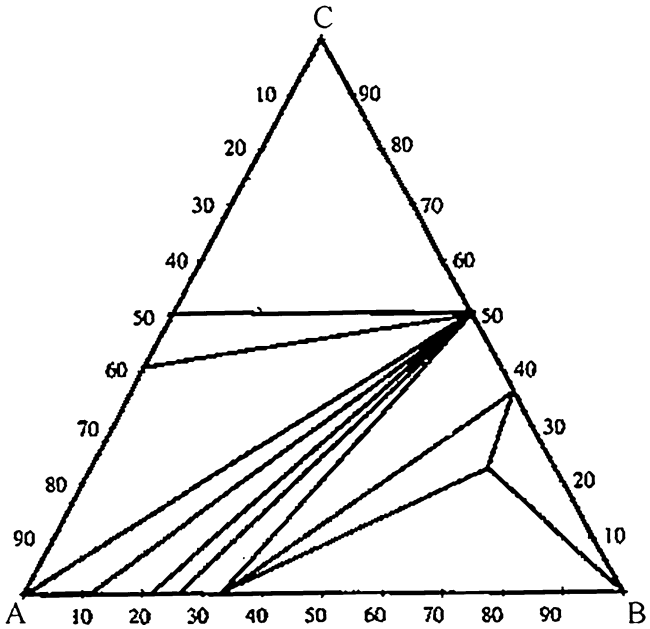

Fig. 1 Equilateral triangle distorted to an isosceles triangle with BC = CA > AB

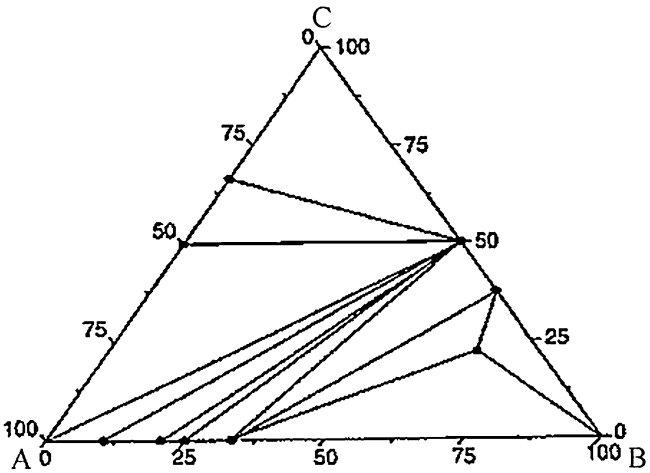

Fig. 2 Equilateral triangle distorted to an isosceles triangle with BC = CA < AB

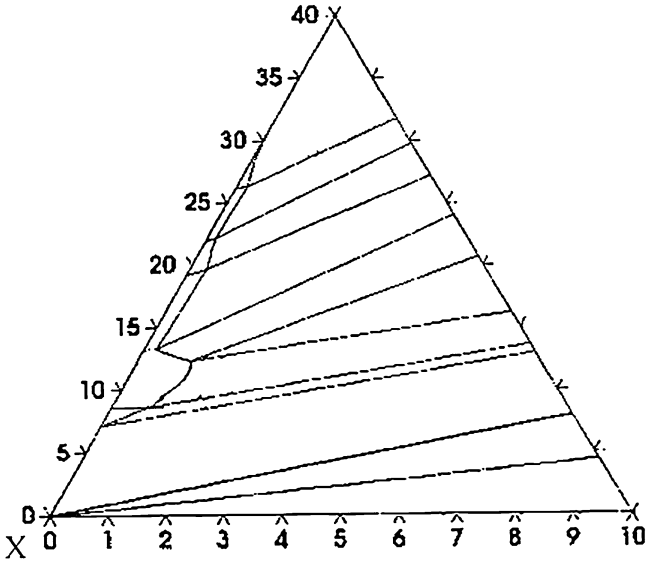

Fig. 3 Equilateral triangle used to plot axes with different scaling

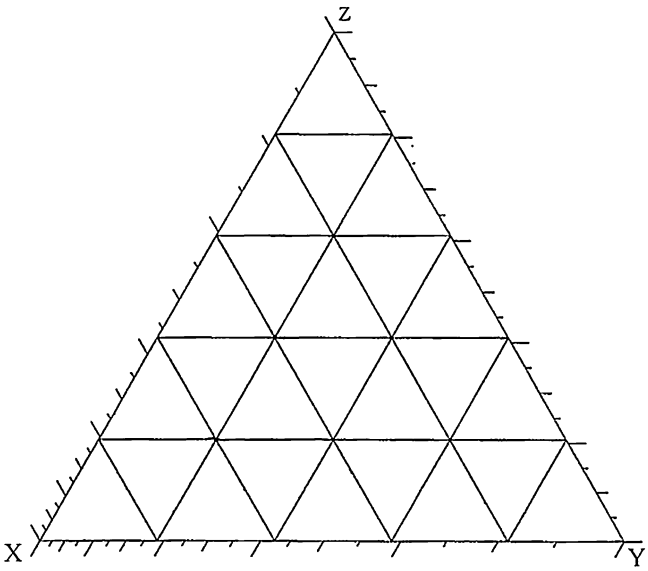

Fig. 4 Non-linear mass percent markings along the sides cannot be extended into the triangle

there still remain some problems. Figures 1 and 2 are examples where data are plotted on isosceles triangles! In Fig. 1 from a 2004 publication, sides BC and CA are about 5% longer than side AB. In Fig. 2 from a 2006 publication, sides BC and CA are shorter by 13% as compared to AB! While it is possible to read compositions from such triangles, it is not as straightforward as with equilateral triangles. A transparent triangular graph cannot be superimposed on such diagrams to read directly the composition. There are other such examples appearing occasionally in front-line journals publishing phase diagrams. One wonders why such non-standard triangles are used. It is also possible that the distortion could appear at the printing stage. To suit his space-fitting needs, the printer can change occasionally the height of the triangle electronically, keeping the base constant! The authors would do well to check the proofs carefully before approving, in case the distortion occurs at the printer's office.

One other problem is the mismatch between listed values of ternary compounds and what is shown on the triangle. In a 1995 publication, correcting the location of a ternary compound to match the listed value resulted in a change of the triangulation involving the ternary phase! Enough experimental points were not available in this paper to know whether the triangulation

shown by the authors was indeed found experimentally. Such a problem is easily avoided, by using computer software available now to plot experimental data.

A less common example is the use of different scales to plot data on an equilateral triangle. This is usually done for better clarity. Figure 3 from a 2005 publication is an example. In such cases, the use of rectangular coordinates is preferable for easy reading of the plotted data. Figure 4 is an example where grids are in atomic percent. The sides of the triangle are marked in mass percent on a non-linear scale. The use of such markings is limited to the binaries, as one cannot extend them into the triangle to read ternary compositions in mass percent.

In conclusion, I request authors to always use the Gibbs equilateral triangle accurately without distortion, to facilitate the work of a potential user of the data. Please also label phase fields as completely as possible, without the reader having to make guesses!

V. Raghavan
Formerly Professor of Materials Science
Indian Institute of Technology, Delhi