Designation: E 391 – 95

Standard Practice for Presentation of Phase Diagrams[1, 2]

This standard is issued under the fixed designation E 391; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the drawing of binary phase diagrams and isotherms through ternary phase diagrams for publication.

2. Referenced Documents

2.1 *ASTM Standards:*

E 7 Terminology Relating to Metallography[3]

2.2 *American National Standard:*

ANSI Y15.1-1959 Illustrations for Publication and Projection[4]

3. Terminology

3.1 *Definitions*—For definitions of terms used in this standard, see Terminology E 7.

4. Significance and Use

4.1 Phase diagrams are graphical representations of the equilibrium composition limits of the phases in an alloy system as a function of temperature and pressure. Pressure is generally assumed to be constant at 1 atmosphere (101.3 kPa) in metal systems.

4.2 This practice establishes a procedure for publishing phase diagrams so as to maintain congruency regardless of publication and alloy source.

5. Grid and Scale for Binary Diagrams

5.1 Binary phase diagrams should be plotted on a rectangular grid having a spacing of 1 cm in each direction. The scale to be used on each axis (temperature and composition) should be such that intermediate values can be measured easily with the use of a scale graduated in millimetres. For example, on the temperature scale (ordinates) 1 cm might equal 10, 50, 100, or 200°C; and on the composition scale (abscissae) 1 cm might equal 1, 5, 10, or 20 %. The choice will depend upon whether the diagram covers the whole system or only a part, as well as the size of the printed reproduction.

6. Locations of Scales on Binary Diagrams

6.1 The Celsius temperature scale should appear along the left-hand side of the diagram and should correspond with the horizontal lines of the centimetre grid. The use of the Fahrenheit scale along the right-hand side of the diagram is optional.

6.2 Scales for both weight percent and atomic percent should be used. It is preferable to place the weight percent scale along the bottom, and it should correspond with the vertical lines of the grid, because the reading of the intermediate values is used with weight percent in preparing alloys and in plotting results. The atomic percent scale is placed along the top of the diagram.

7. Indicating Atomic Ratios in Binary Diagrams

7.1 Atomic ratios are clearly indicated by the scale of atomic percentages along the top of the diagram. The use of arrows for this purpose is unnecessary and may be confusing where there is no phase having the stoichometric ratio indicated. Therefore, they are not recommended.

8. Ternary Diagrams

8.1 Complete presentation of ternary diagrams requires a three-dimensional model (a right prism) the base of which is an equilateral triangle. Compositions are plotted on the base, and temperatures perpendicular to the base. However, a perspective drawing of such a model cannot be measured accurately, and so ternary diagrams are preferably published in the form of isothermal sections, or as the projections of certain surfaces on the base.

8.2 Compositions are plotted on an equilateral triangular grid (the Gibbs triangle). This triangular grid should have spacings of 1 cm in each of the three directions. Compositions should be plotted in weight percent. The selection of scales is the same as for binary diagrams.

9. Quasi-Binary Sections of Ternary Diagrams

9.1 Certain sections perpendicular to the base of the model and connecting two single-phase regions look like binary diagrams. They are called quasi-binary diagrams and are very useful. They should be plotted just as binary diagrams are plotted. The use of other vertical sections is not recommended.

10. Labeling Phase Fields

10.1 Single-phase fields should *always* be labeled with the phase designation. Two-phase or three-phase fields may be

---

[1] This practice is under the jurisdiction of ASTM Committee E-4 on Metallography and is the direct responsibility of Subcommittee E04.02 on Metallographic Terminology and Nomenclature of Phase Diagrams.

Current edition approved July 15, 1995. Published September 1995. Originally published as E 391 – 69. Last previous edition E 391 – 90.

[2] Phase diagrams are also known as equilibrium or constitutional diagrams.

[3] *Annual Book of ASTM Standards*, Vol 03.01.

[4] Available from American National Standards Institute, 11 West 42nd Street, 13th Floor, York, NY 10036.