



# PHOSPHOR HANDBOOK

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*Edited by*

Shigeo Shionoya  
William M. Yen

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# PHOSPHOR HANDBOOK

*Edited under the Auspices of*  
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## Phosphors for lamps

Shigeru Kamiya

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### 5.2 Classification of fluorescent lamps by chromaticity and color rendering properties

There are many kinds of fluorescent lamps of different chromaticities and different color rendering properties. According to the appropriate or particular application, lamps with suitable color chromaticity and color rendering can be chosen. In Japan, the classification of fluorescent lamps for general lighting is described in the *JIS Standard Z9112*<sup>1</sup> in accordance with the chromaticity and color rendering properties.

*Classification by light source color.* The described chromaticity ranges of five different colors in *JIS* are shown in Figure 2, together with the IEC specification. Designations and symbols of these five colors are shown in Table 3 as compared with those commonly used outside Japan. The 5000-K lamp is exceptionally popular in Japan.

*Classification by color rendering properties.* Various kinds of descriptive wording are used by manufacturers to describe the degree of improvement in the color rendering of their lamps; words such as Deluxe type, Super Deluxe type, Natural Color, etc. are commonly encountered. *JIS* first introduced a standard designation system according to the color rendering indices and characteristics of the spectral power distribution.

Fluorescent lamps with wide band spectra are classified into four types: ordinary type, color rendering A type, color rendering AA type, and color rendering AAA type, depending on the degree of improvement of the color rendering indices. The minimum required values of the general color rendering index and special color rendering indices of the lamp belonging to each category are given in Table 4. For narrow band fluorescent lamps, in addition to the requirement for color rendering indices, the ratio of the radiant flux within the three specified band wavelength regions to that in the entire visible wavelength region are specified. The symbol for narrow band lamps satisfying the values described in Table 5 is designated as EX.

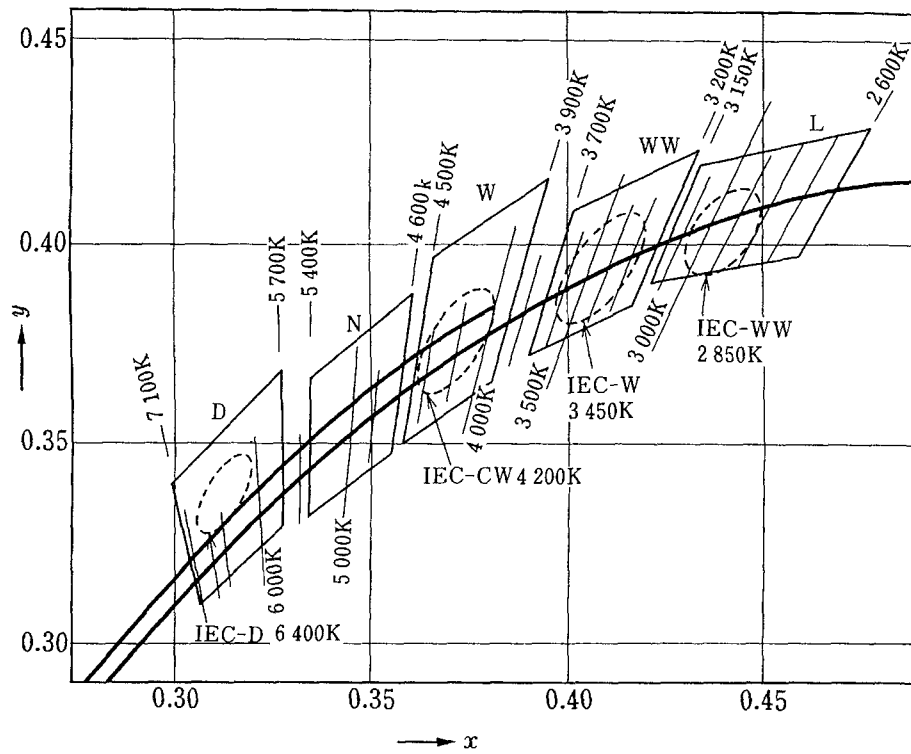


Figure 2 Chromaticity range of light source colors of fluorescent lamps (From JIS Standard Z 9112 1990 With permission)

Table 3 Chromaticity Range of Light Source Colors of Fluorescent Lamps

| JIS 9112           |        |                 |             |      |
|--------------------|--------|-----------------|-------------|------|
| Classification     | Symbol | $T_{cp}$<br>(K) | IEC Publ 81 |      |
| Daylight           | D      | 5700-7100       | Daylight    | (D)  |
| Day white          | N      | 4600-5400       | —           | —    |
| White              | W      | 3900-4500       | Cool white  | (CW) |
| Warm white         | WW     | 3200-3700       | White       | (W)  |
| Incandescent color | L      | 2600-3150       | Warm white  | (WW) |

Note Correlated color temperature  $T_{cp}$  values are informative reference  
From JIS Standard Z 9112 1990 With permission

**Fluorescent lamps with wide emission bands** Ordinary fluorescent lamps employ calcium halophosphate phosphors, which have a broad continuous spectra. Emission intensity in the region longer than 600 nm, however, is insufficient to reproduce reddish colors correctly. To improve this shortcoming, various combinations of phosphors have been investigated to realize a continuous emission spectrum close to that of reference light sources such as synthetic daylight and full radiator (blackbody radiator). Lamps constructed with this concept are called wide-band spectrum lamps. For ordinary lamps, only the general color rendering index Ra is specified because these lamps are produced with

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