MEP 2003

Spectral lamp radiations

^{86}Kr, ^{198}Hg, ^{114}Cd, spectral lamp radiations

1 CIPM recommended values

Vacuum wavelengths, λ, for ^{86}Kr, ^{198}Hg and ^{114}Cd transitions

Atom	Transition	λ / pm
^{86}Kr	$2p_9 - 5d'_4$	645 807.20
^{86}Kr	$2p_8 - 5d_4$	642 280.06
^{86}Kr	$1s_3 - 3p_{10}$	565 112.86
^{86}Kr	$1s_4 - 3p_8$	450 361.62
^{198}Hg	$6^1P_1 - 6^1D_2$	579 226.83
^{198}Hg	$6^1P_1 - 6^3D_2$	577 119.83
^{198}Hg	$6^3P_2 - 7^3S_1$	546 227.05
^{198}Hg	$6^3P_1 - 7^3S_1$	435 956.24
^{114}Cd	$5^1P_1 - 5^1D_2$	644 024.80
^{114}Cd	$5^3P_2 - 6^3S_1$	508 723.79
^{114}Cd	$5^3P_1 - 6^3S_1$	480 125.21
^{114}Cd	$5^3P_0 - 6^3S_1$	467 945.81

For ^{86}Kr, the above values with a relative expanded uncertainty $U = 2 \times 10^{-8}$, where $U = ku_c$ ($k = 3$), apply to radiations emitted by a hot-cathode discharge lamp containing ^{86}Kr, of a purity not less than 99 %, in sufficient quantity to assure the presence of solid krypton at a temperature of 64 K, this lamp having a capillary with an inner diameter from 2 mm to 4 mm and a wall thickness of about 1 mm.

It is estimated that the wavelength of the radiation emitted by the positive column is equal, to within 1 part in 10^8, to the wavelength corresponding to the transition between the unperturbed levels, when the following conditions are satisfied:

- the capillary is observed end-on from the side closest to the anode;
- the lower part of the lamp, including the capillary, is immersed in a cold bath maintained at a temperature within one degree of the triple point of nitrogen;
- the current density in the capillary is (0.3 ± 0.1) A · cm^{-2}.

For ^{198}Hg, the above values with a relative expanded uncertainty $U = 5 \times 10^{-8}$, where $U = ku_c$ ($k = 3$), apply to radiations emitted by a discharge lamp when the following conditions are met:

- the radiations are produced using a discharge lamp without electrodes containing ^{198}Hg, of a purity not less than 98 %, and argon at a pressure from 0.5 mm Hg to 1.0 mm Hg (66 Pa to 133 Pa);
- the internal diameter of the capillary of the lamp is about 5 mm, and the radiation is observed transversely;
- the lamp is excited by a high-frequency field at a moderate power and is maintained at a temperature less than 10 °C;
- it is preferred that the volume of the lamp be greater than 20 cm^3.

For ^{114}Cd, the above values with a relative expanded uncertainty $U = 7 \times 10^{-8}$, where $U = ku_c$ ($k = 3$), apply to radiations emitted by a discharge lamp under the following conditions:

- the radiations are generated using a discharge lamp without electrodes, containing ^{114}Cd of a purity not less than 95 %, and argon at a pressure of about 1 mm Hg (133 Pa) at ambient temperature;
- the internal diameter of the capillary of the lamp is about 5 mm, and the radiation is observed transversely;
- the lamp is excited by a high-frequency field at a moderate power and is maintained at a temperature such that the green line is not reversed.

2. Source data

The recommended wavelengths are those recommended by the CIPM in 1963 [1, 2].

3. References

[1] *BIPM, Com. Cons. Déf. Mètre*, 1962, **3**, 18-19

[2] *BIPM, Proc. Verb. Com. Int. Poids et Mesures*, 1963, **31**, 26-27.