Conversion from a wavelength-dependent into an energy-dependent spectrum

David Enseling

Thomas Jüstel

29. 07. 2013

Institute for Optical Technologies

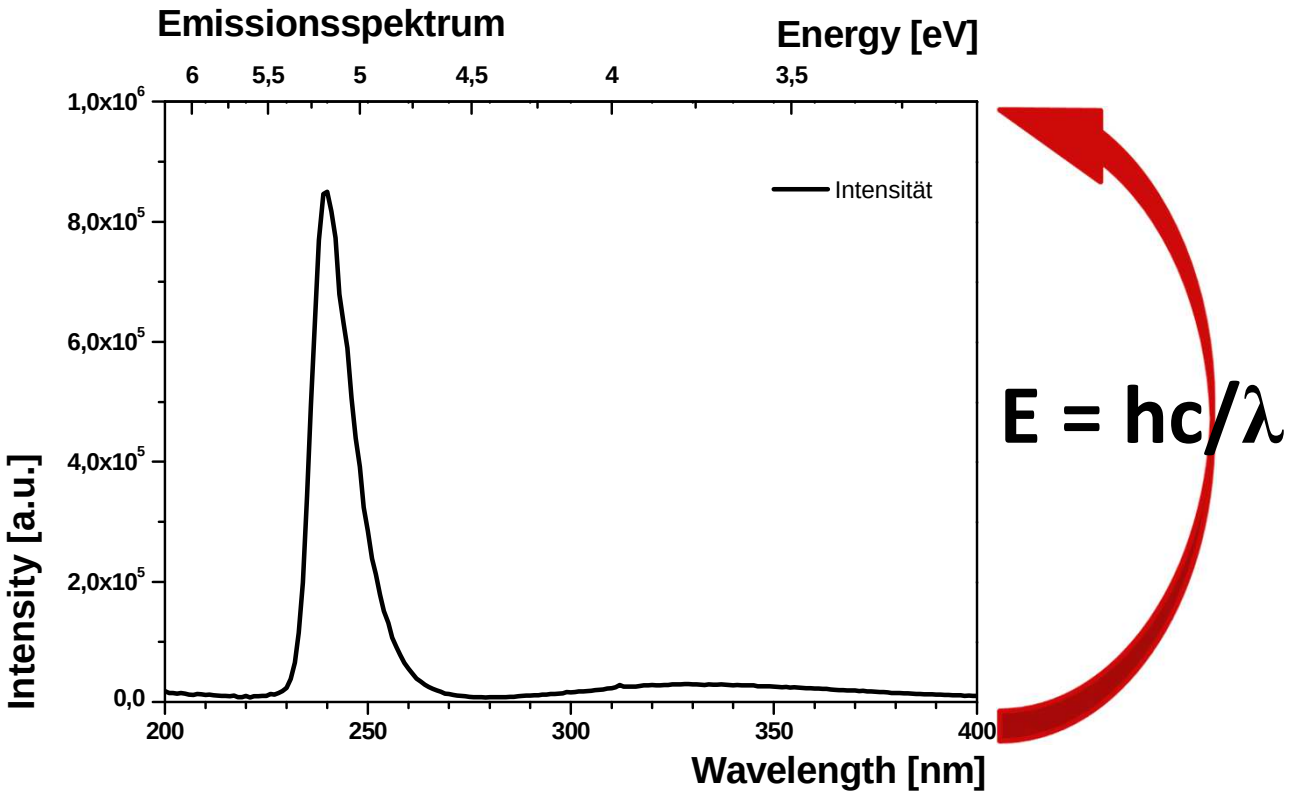
FH MÜNSTER University of Applied Sciences

TOM Tailored Optical Materials

consideration

The following equation is often only used for the converting from a wavelength-dependent to an energy-dependent abscissa:

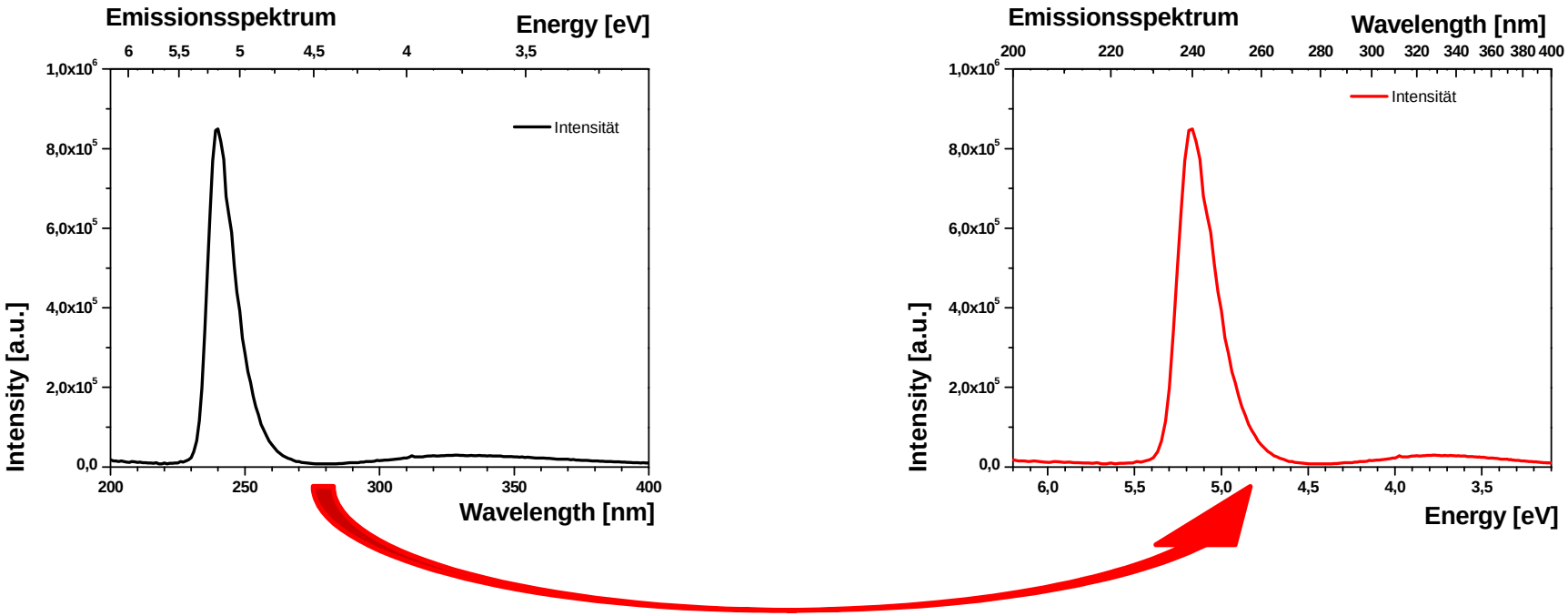
$$E = hc/\lambda$$



The form of the graph does not change by this operation!

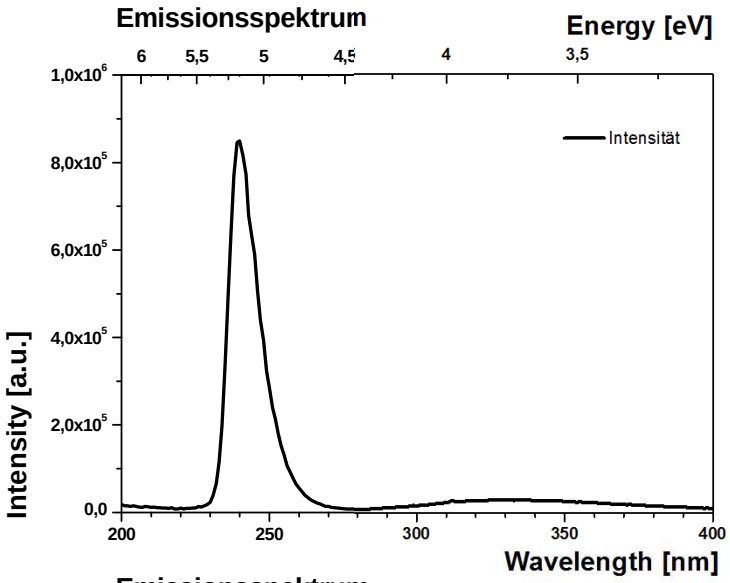
consideration

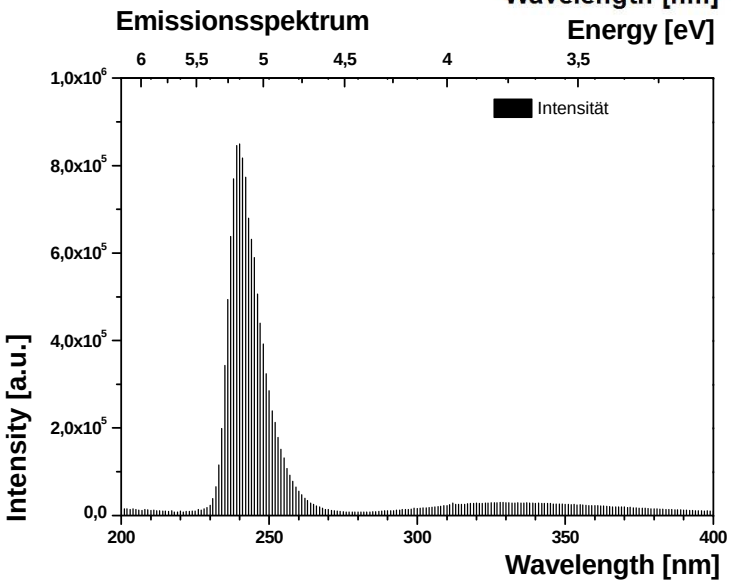
If you look at what changes after inserting the reciprocal scale, you will conclude that the ordinate (intensity) also must be changed.



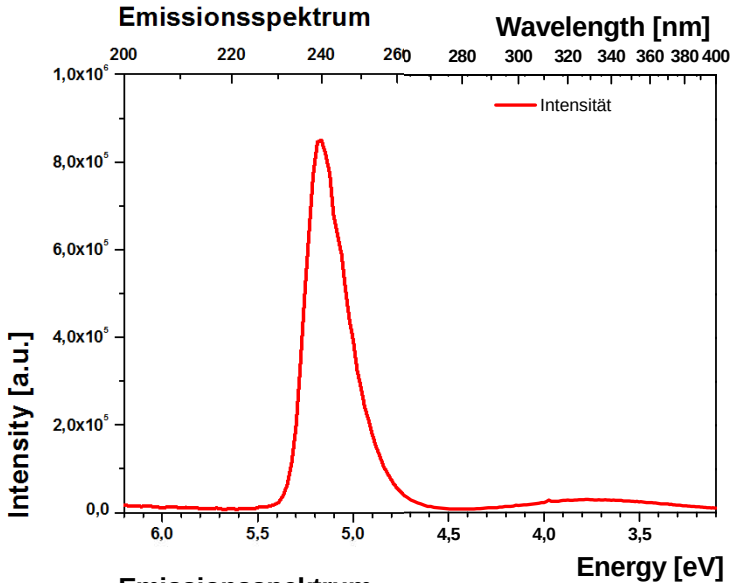
Conversion of the abscissa without changing of the intensity

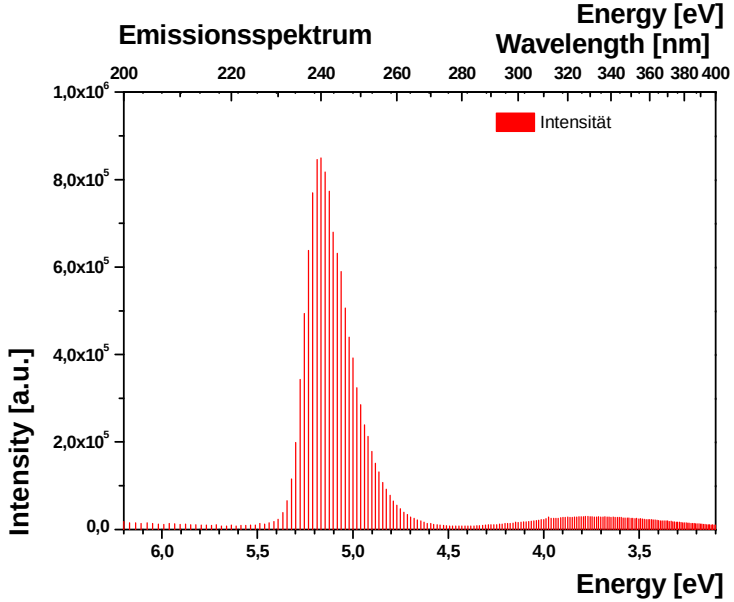
consideration





Conversion of abscissa without changing of intensity

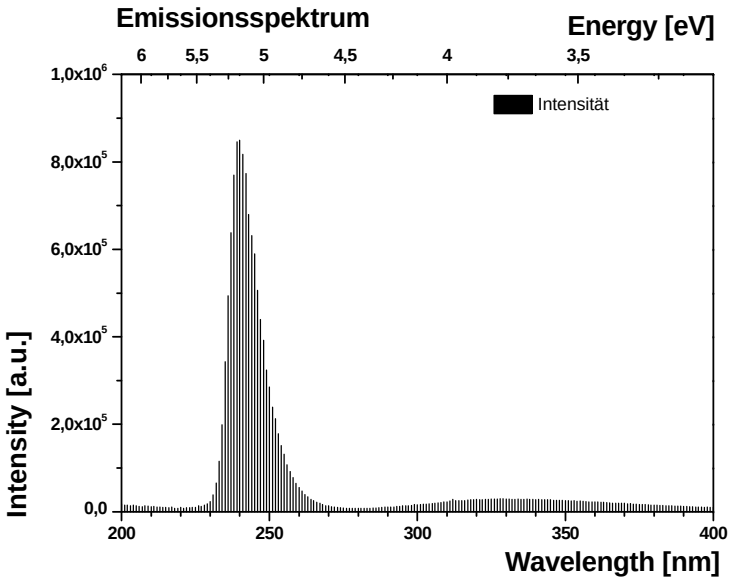


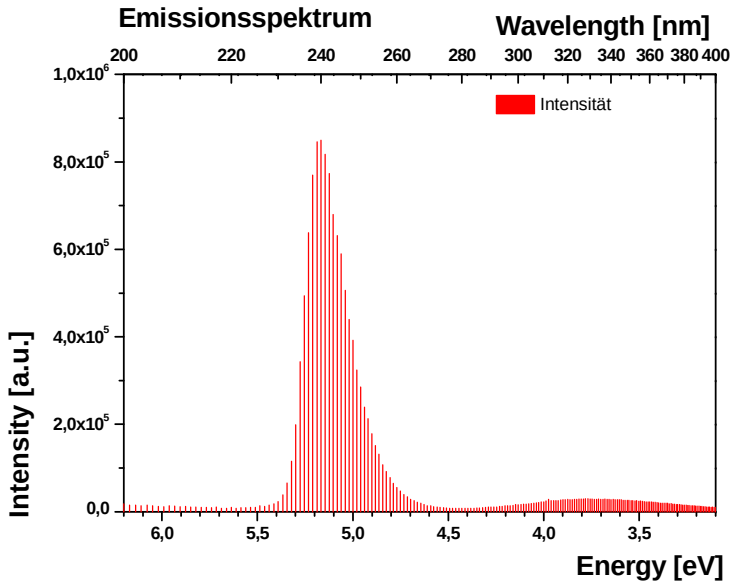


Always: equal gap width within wavelength

Changed gap width over energy

consideration

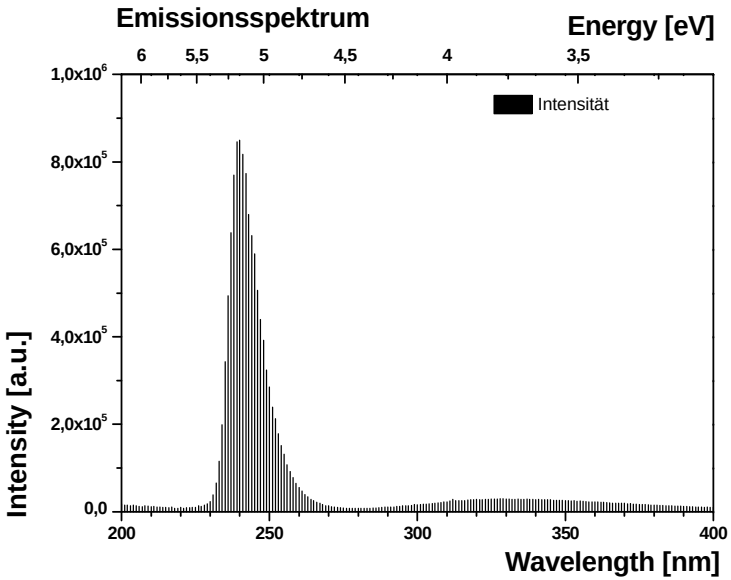


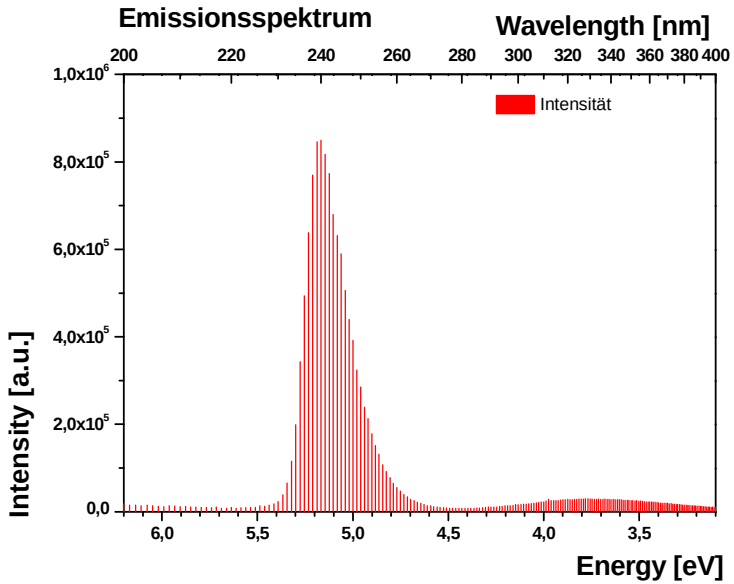


With a look at the upper spectrum (left) you see a constant distance between the individual measuring points and the gap width by the record of an emission spectrum depending on the wavelength. This means, that the wavelength interval is constant over the whole spectrum e.g. 1 nm.

But in the converted spectrum (right) changes the distance between the measuring points and the energy interval, which is measured (the gap width of the energy domain changed over the spectrum).

consideration



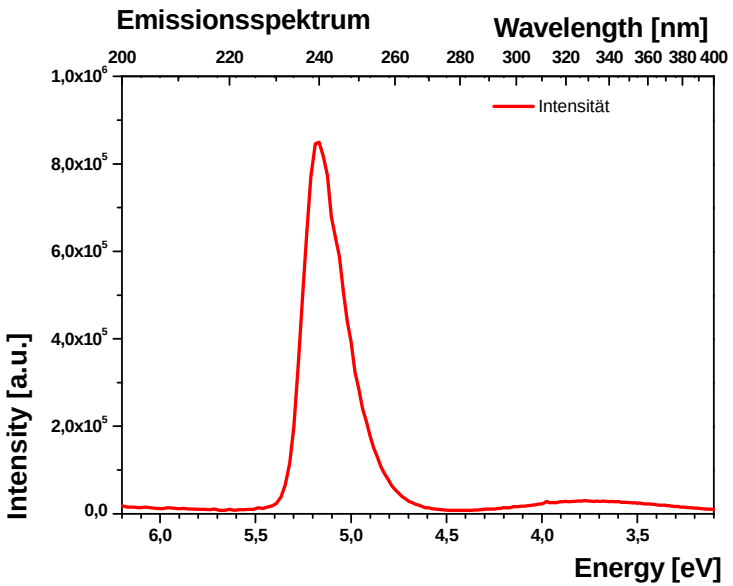


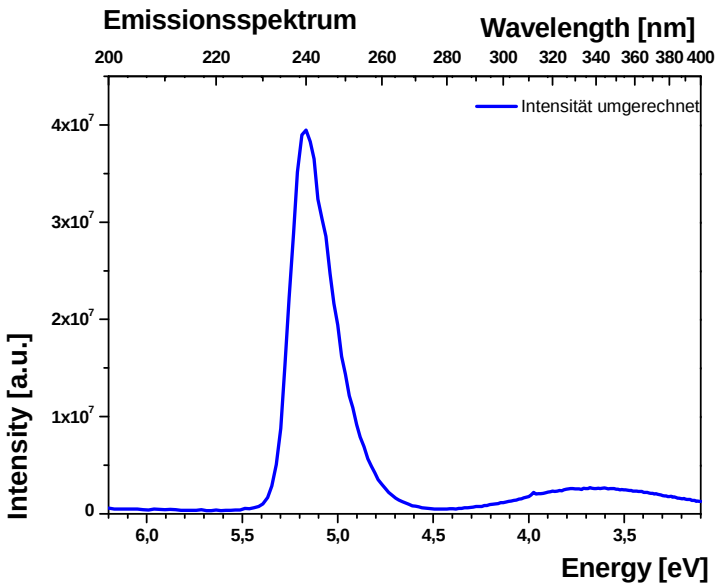
The intensity has to converted to obtain a constant gap width after converting wavelength into energy.

derivation integration

$E = h*c*\lambda^{-1}$ → $dE = h*c*\lambda^{-2}*d\lambda$ → $\underline{I_E = I_\lambda*\lambda^2(hc)^{-1}}$

calculation specification





$$I_E = I_\lambda * \lambda^2 (hc)^{-1}$$

conclusions

- Changes by the conversion:
  - The integral
  - The intensity maximum
  - The centriod wavelength

- Note therefore:
  - Information about the scale of a graph
  - For which scale the maximum is given

D1

usage

The conversion will mainly used for emission spectra.

Reflection spectra are measured against a reference (e.g. $BaSO_4$). The influence of the changes of the interval (gap modification) is eliminated because of dividing the sample by the reference.

Excitation spectra are measured against a reference (e.g. sodium salicylate). The influence of the changes of the interval (gap modification) is eliminated because of dividing the sample by the reference. (VUV-spectrometer)

Or in the excitation spectra will directly eliminated the influence of the changes of the interval (gap modification), if a reference detector is mounted behind an excitation monochromator, which continuous correct the spectrum. (fluorescence spectrometer)

Folie 9

D1 David; 20.12.2016

sources

- G. Blasse „Luminescent Materials“, Springer-Verlag, 1994, page 225