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Dear Sirs Q - Lights CO., LTD

Concerning evaluation results of the OEL elements

Concerning OEL elements made from common materials, we performed evaluation of them and reports the results bellow.

○Evaluation item

①□ The OEL element appearance and the light-emitting surface observation

②□ EL spectrum measurements

③□ Electric current・Voltage・Luminance (IVL) characteristics evaluations

④□ Luminance half-life evaluation

○Preparation conditions of the OEL elements

- Cleaning process of the ITO substrates
  The cleaning environment: clean booth (class100) in the clean room (class 10,000)
  Solvent: detergent for cleaning semiconductor (two types of the organic alkaline aqueous solution etc), hyperpure water (18MΩ, TOC:~10ppb)
  Equipment: ultrasonic cleaning equipment (26 kHz & 950 kHz), oxygen plasma cleaning equipment

- Vapor deposition process *This is common to all the deposited layers of elements
  Vacuum degree: $1\sim2\times10^{-4}$Pa
  Vapor deposition rate: 1.0~2.0 Å/s

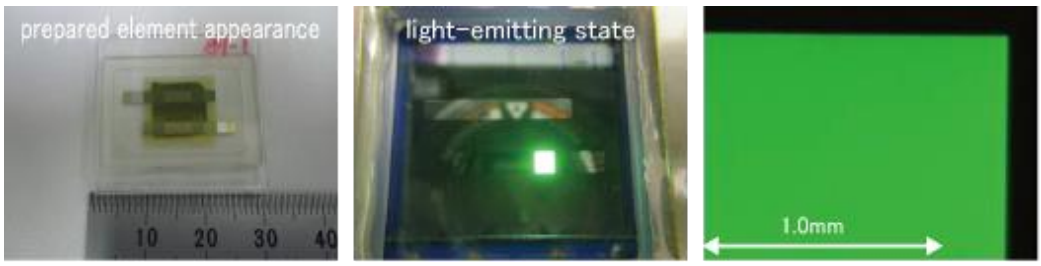
- OEL element structure Unit: nm
  Glass/SiO_2[53]/ITO[55]/CuPc[25] α-NPD[35]/Alq[50]/LiF[0.8]/Al[150]
  The thickness of the glass substrate: 0.7mm
  Light-emitting parts area: $2.0\times2.4mm^2$

- Sealing
  Environment: $H_2O\&O_2$ less than 10ppm
  Sealing cap: made of Aluminum
  Using OEL sealing agent and the getters (Dehumidification /oxygen removal agent)

○Results of the evaluation

①The element appearance and the light-emitting surface observation

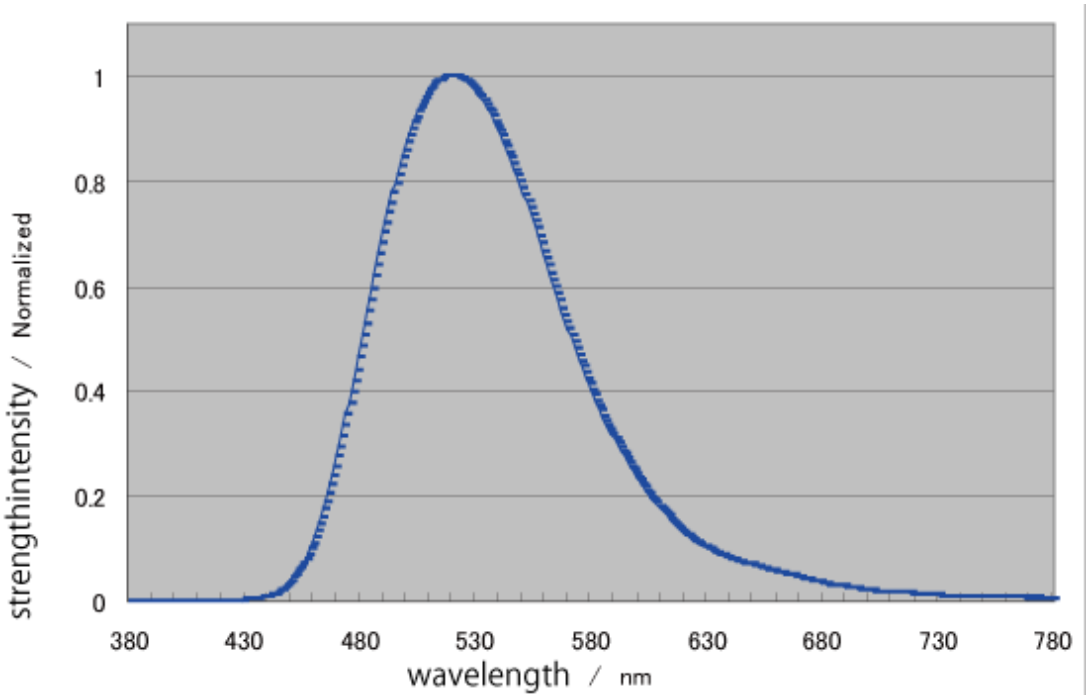
It was found that elements had a good light-emitting surface without the light (dark) spot, when we observed the enlarged (20 times) light-emitting part.



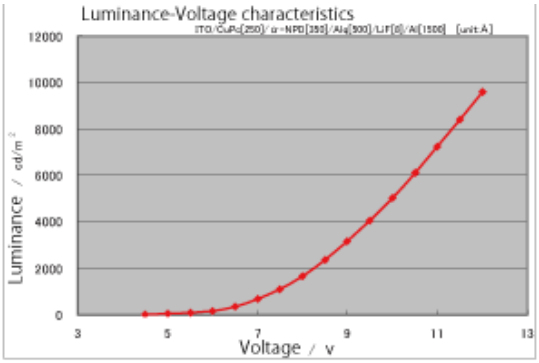
(The prepared element appearance and the light-emitting state) (The light-emitting surface of an element)

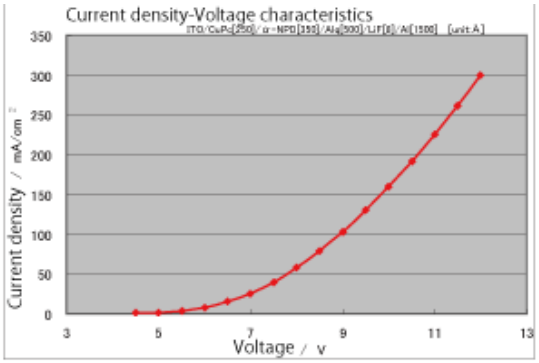
②EL spectrum measurements

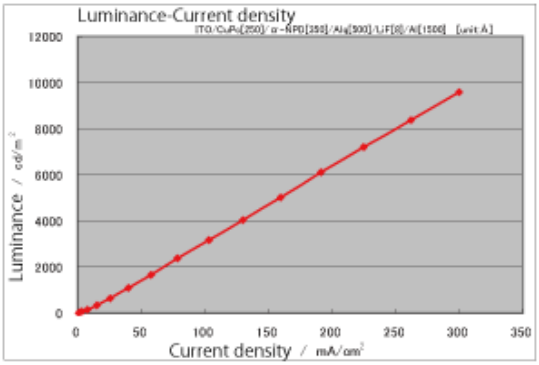
The following shows EL spectrums of the prepared OEL element made from common materials. Spectrums of Alq peculiar that have a peak at about 520nml were obtained.

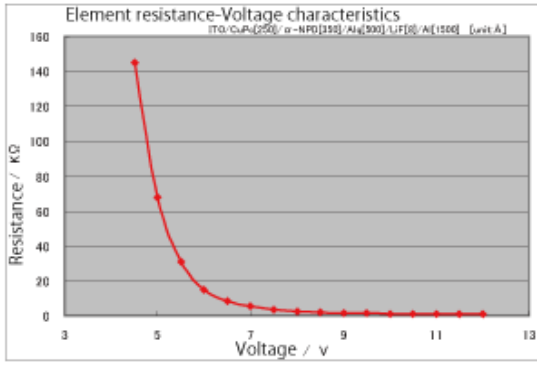


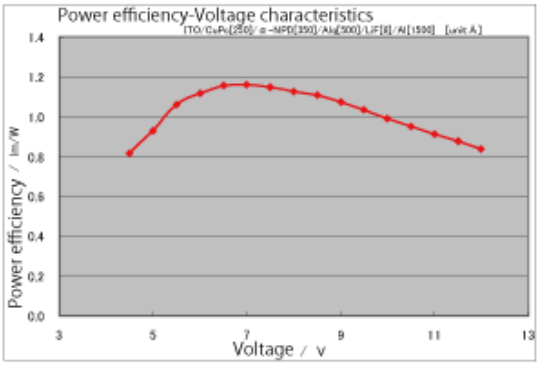
③Electric current/ Voltage/ Luminance (IVL) characteristics evaluation

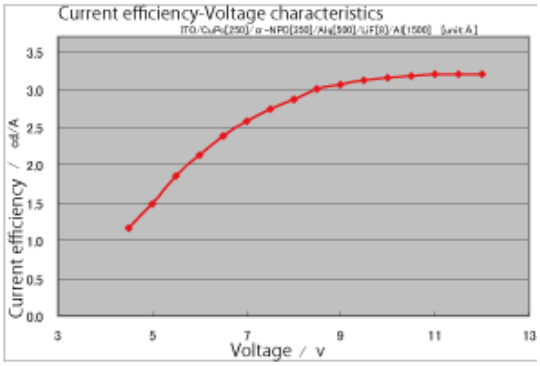












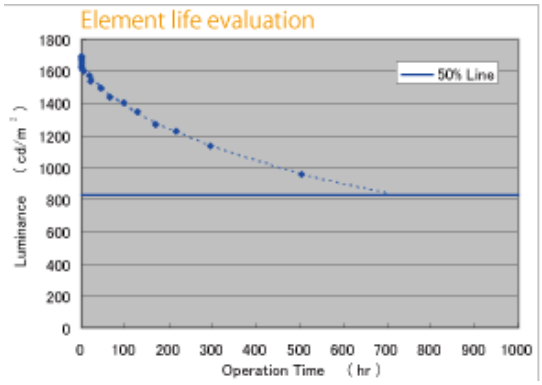
④Luminance half-life evaluation

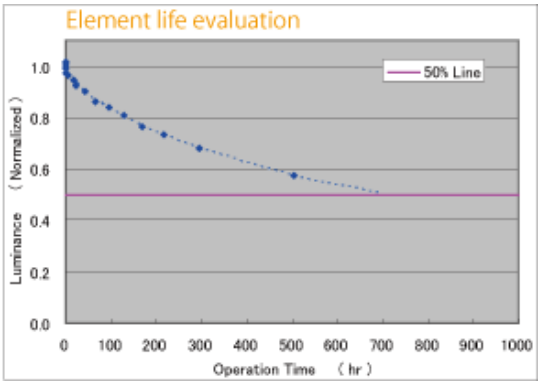
Predicted that the first luminance which reaches half of the luminance in the drive time of within 1000 hours would be about 1700 cd/m² roughly, we performed the luminance half-life evaluation. In addition, we performed aging to stabilize light-emitting luminance of elements under the following conditions.

(The aging conditions)

- Luminance: about 800 cd/m²
- Constant current driving: 1.2mA
- Driving current: 10 minutes

The results of the evaluation are shown in the graph. The vertical axis shows the luminance, and the graphs are standardized as the value of first luminance is 1.





○Comment

If there are any questions about element preparation process or evaluation method, please feel free to contact us.

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