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LED RELIABILITY TEST FOR GENERAL LIGHTING

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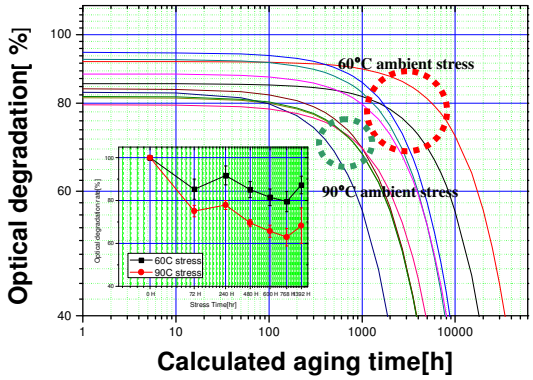
LED luminaire available today often claim long life, usually 50,000 hours, which exceeds the life ratings of nearly all other light sources. These claims are based on the estimated lumen depreciation of the LED used in the product and often do not account for other component of failure mode. In this article, We have measured lumen description testing results for 3 SSL(Soid state lighting) products. And we had performed accelereated life test using ambient temperature stress condition. And Data analayses were performed using a exponential decay model. In this way, We show results of LED luminaries reliability testing.

Introduction

Light-emitting diodes(LEDs) are obtaining a significant in many important applications such as automotive, street lights, and general lighting thanks to their energy saving, long operative life, easiness in integration etc. Improvements of LED structure and use of new materials had permitted the development, in terms of device efficiency and color availability, achieved in the last years. Therefore, the study of blue LEDs becomes relevant to develop efficient light sources for the above-mentioned applications. One of the LEDs' most important advantages is the longer life with respect to other light sources such as incandescent bulbs, but this characteristic depends on many manufacturing factors, for instance, thermal resistance between chip and air, plastic encapsulation, semiconductor defects, etc. In this way LED luminaire available today often claim long life, usually 50,000 hours, which exceeds the life ratings of nearly all other light sources.[1] These claims are based on the estimated lumen depreciation of the LED used in the product and often do not account for other component of failure mode.[2] In recent, LM-80[IESNA Approved Method for Measuring Lumen Maintenance of LED Light Sources] test procedure had showed to the life of and LED luminaire. According to the LM-80 test, Lumen depreciation of the LED device is the one factor in the life of an LED luminaries. When LEDs are installed in a luminaire or system, there are many additional factors that can effect the speed of lumen depreciation or the likelihood of catastrophic failure[2]. These include temperature extremes, humidity, moisture incursion, voltage or current fluctuation, failure driver or other electric components, damage or degradation of the encapsulation material, damage to the wire bonding that connect the LEDs, LED device joint failure and degradation of the phosphors, etc.[3]. Especially excessive temperature treatment is main cause for lumen depreciation and then certainly LED luminaire lifetime analysis. For described table1. we tested lumen maintenance measurements to 6ea LED luminaire product during 2862hr.

LED Luminaire without converter Lifetime Measure and analysis



Ambient Temp.	quantity	Propose	Tested time
60。C	5ea	Accelerated Life test	1,500hours
70。C	5ea		

LED illumination products, has a lifetime rating and reliability rating. MR16 type of without convetor, DC12V lighting is to work. 60C and 90C accelerated stress conditions, and test time is 1500 hours, and failure condition. Is lumen depreciation 70% and color coordinate difference 7 step Macadam ellipse.

LED Lighting Products, through the lifetime of the product each time, depending on the temperature could be evaluated. Each accelerated condition is ambient temperature. And measured figures is below. From Exponential degradation, LED lighting product's life time measurement. And color coordinate no change in acceleration condition

We we measured life time caculated life time is 60,000hr using expotential extrapolation.

And we each accelerated condition life time condition calculated expotential extrapolation and life time distribution model is weibull modeling and accelerated modeling is Arrhenius modeling. In conclusion Room temperature life time is 5500hr.

LED Luminaire with converter Lifetime Measure and analysis

Table 1. LED luminaire lifetime test conditions

Ambient Temp.	quantity	Propose	Tested time
R.T.	6ea	Lumen maintenance measurements	2862hr,
40。C	3ea	Accelerated Life test	684hours
70。C	5ea		
90。C	5ea		

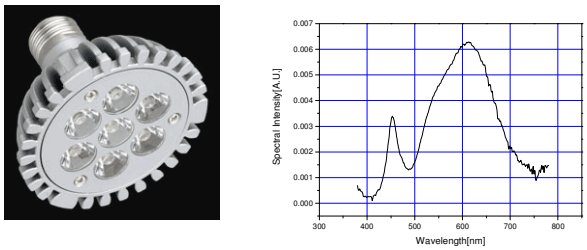


Fig.1. Tested LED luminaire and Spectral distribution.

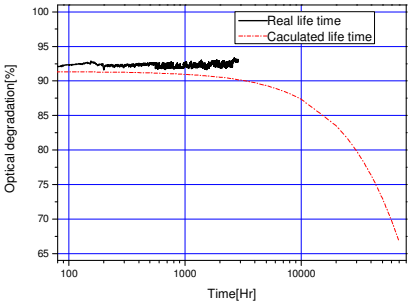


Fig.2. Real lumen depreciation testing vs Example of exponential depreciation to L70 (not an actual product)

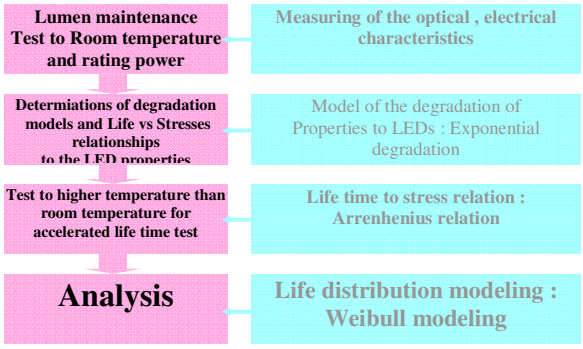


Fig.3. Flow chart of test procedure

For Fig.1 we tested 7W Edison type LED luminaries consist of 7ea 1W power rated LED PKG , control gear AC/DC type and metal case. In this products, we test lumen maintenance test to room temperature with rating power during 2862hr. And then test to higher temperature than room temperature for accelerated life time test. The lumen depreciation testing is not completed for these samples, but there accelerated test is completed for acceptance failure rate. And We analysis life distribution modeling using Weibull model, lumen depreciation modeling using exponential degradation. We had adopted failure criteria in 70% degradation of the initial output lumen characteristics. In summary, LED luminaire life is not identical to estimated LED life. LED luminaire life is also a function of the power supply, operation temperatures, thermal management, materials, and electrical and material intergaces. We we measured life time caculated life time is 60,000hr using expotential extrapolation.

And we each accelerated condition life time condition calculated expotential extrapolation and life time distribution model is weibull modeling and accelerated modeling is Arrhenius modeling. In conclusion Room temperature life time is 5500hr.

So We do not conclue definitive lifetime rating of the LED luminaire.

References

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