三普龍光電材料股份有限公司
SUN PRO OPTRONIC CO.,LTD.

Save energy. Save your eyes.

公司理念：

三普龍光電致力綠色節能照明，提供符合人類生活便利舒適的光源環境，以最尖端微結構光學技術，提供消費者多種高能源效率與無強光害(眩光)的 LED 燈具解決方案，主力產品—FD Film™ 應用於日常生活中之攜帶式光源、桌燈、嵌燈與各式各樣之室內 LED 燈具，以幫助每位客戶建立無汞、無毒、無光害之潔淨生活照明。

Company Philosophy:

Sun Pro Optronic Co., Ltd. is devoted to the lighting in green energy-saving and provides people more convenient and comfortable lighting environment. We have been developing advanced technology of the lighting , and providing many kinds of high efficiency and non-hurt strong light (glare) of LED lighting solutions for consumers. Our product, FD film™ could be applied to many kinds of LED lighting products, such as portable light , desk lamp , down light, etc. That will help every customer enjoys the clean and comfortable lighting of life with mercury-free, non-toxic and non-lighting hurt.

LED 照明之完全解決方案

您曾有過被高亮度 LED 眩得滿天金星，甚至眼前一堆黑影久久不散嗎？此是因 LED 為點光源，點光源會造成強光點，所以無法用眼睛直視，在提倡節約能源與綠色照明的同時，你能想像越來越多的高亮度 LED 光源在你的生活周遭，隨時隨地讓您的眼睛受到傷害嗎？

當 LED 亮度進入一般照明應用時，所注重的問題不外乎是效率、壽命、散熱與電子控制等，然而這類的產品往往忽略對於眩光處理及重疊影的重要性。強光會損害眼睛，在不知不覺中影響視力，高亮度的 LED 光源所形成的強光點，瞬間會影響視覺的判斷力，短期產生不適與眼睛疲勞，長期則會產生永久性的傷害。

Had you ever been dazzled or haunted by a pile of shadows for a long time after staring at the LED for a while? Because the LED light is point-light source and the point light will create a strong luminous spot, it is too bright to see directly by eyes. Can you imagine there're more and more high light LED around you and hurt your eyes anytime and anywhere while the governments around the world are promoting energy saving and environmental protection of lighting ?

When it comes to the normal LED lighting application, people only care about the luminous efficiency, lifetime, heat radiation and the electronic control. However, they always neglect to resolve the problem of overlaps of the shadows in these kinds of products. Strong light will damage our eyes insensibly. The strong light point which comes from the high luminous LED light source will affect the visual judgment at the moment and will make you feel uncomfortable or tired in a short time. For a long time, it will even cause the permanent hurt.

高效率防眩光學膜科技

三普龍光電為了同時兼顧綠色照明的光效率與強光害問題，斥巨資開發新發明專利尖端抗眩光學膜技術 Focal Diffuser Film™ 技術，簡稱 FD Film™，此技術可以將 LED 的強光點在極短的距離內均勻擴散並重新改變光的分佈 (大廣角±85° 即 170°), 在搭配適當的燈具設計下，光效率最高可達 95%，經由 FD Film™ 處理過後的 LED 燈具光源，可以完全免除 LED 強光點的問題，並維持 LED 燈具原有的輕薄與高光使用效率。新開發之 Focal Diffuser 光學膜特殊光學功能如下：

The Technology Of High Efficiency And Anti-glare For LED Lighting Diffuser Film

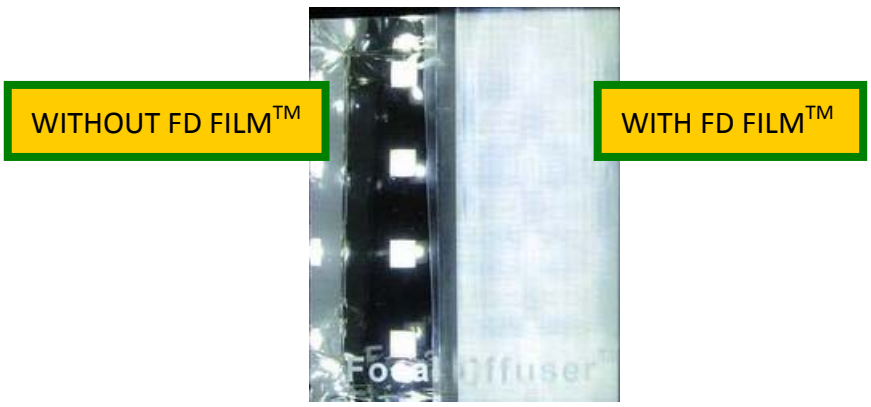
Sun Pro Optronic Co., Ltd. takes both the efficiency and damage of strong light into consideration, and uses the patented technology –Focal Diffuser Film™ to solve both light efficiency and the glare problem. Focal Diffuser Film™ can overcome the existed problem and diffuse the strong luminous points of LED in an extremely short distance and change the light distribution (wide angle : ±85 degree equal to 170 degrees). The light efficiency can reach almost 95% in appropriate designed lamps and lanterns. After using the FD film, the light of LED lamp will become gentle and comfortable to our eyes and it also can completely avoid the problem of the strong light point of LED and keep the slim size and the high light efficiency of LED lamp. The features of Focal Diffuser film™ are as follows:

1. 極佳點光源擴散效果與超高光利用效率 95%

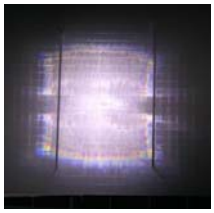
圖一中所見為 1W 高瓦數 LED 燈源使用 Focal Diffuser 光學膜的對照使用情形，左側強烈 LED 點光源無法直視，右側使用 FD 光學膜後，變成均勻的面光源<FIGURE 1>，為克服眩光問題，一般會使用傳統擴散膜、擴散板或晶板等現有的擴散材料，但往往不是造成光效率變差(約 50%-60%)，若光效率超過 60%就無法將光均勻擴散及改善眩光問題。比較不同擴散材料的功能，在同樣的測試條件下，表中可以清楚見到使用 Focal Diffuser 光學膜的強大擴散功能，將光點擴散後自然就會降低 LED 眩光，無論使用高瓦數或是低瓦數的 LED 光源都有此功能。<FIGURE 2>

A. Excellent Light Diffused Effect And 95% Of Light Efficiency

The pictures as below show the comparison “with” and “without” Focal Diffuser film™. The picture left shows you can not see directly the strong point light of LED; the picture shows after using FD film , the light becomes distributed and comfortable. <FIGURE 1> For resolving the glare problem of LED, people usually use the traditional diffuser films, diffuser boards…...the existed diffusing material. Although those products can spread the light evenly, they only keep the light efficiency 50% -60%. However, if the light efficiency is over 60%, it can’t spread the light evenly and improve the glare problem. Comparing the functions of different diffusing materials in the same test condition, we can see the LED light point very clearly without using FD Film. Contrarily, when we use the Focal Diffuser film™, that can diffuse the light uniformly and eliminate the glare problem. After placing FD film™ will easily reduce LED glare, no matter what power LED you use. <FIGURE 2>



<FIGURE 1>

Diffuser Material	T55 Diffuser Sheet	Normal Diffuser Sheet	Focal Diffuser Film™
Transmittance Image (The Same Light Source : 1 W LED)			
Efficiency	50-60%	90%	95%
Remark	The luminance is reduced substantially.	The light point can't be eliminated.	The light point is diffused evenly.

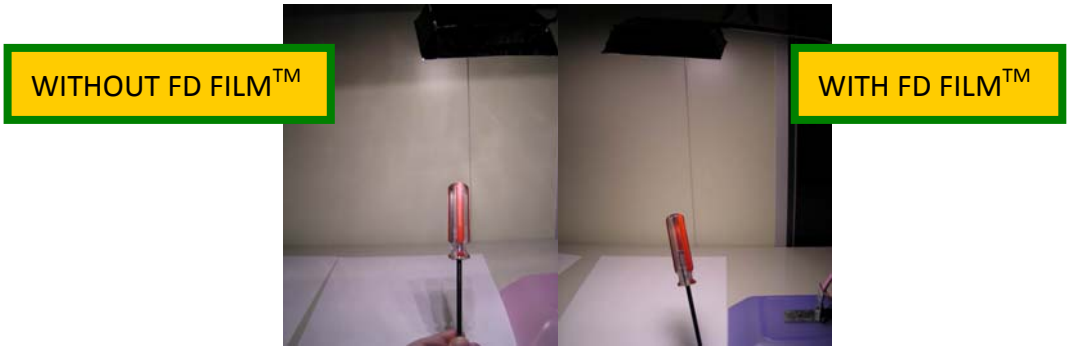
<FIGURE 2>

2. 消除多顆 LED 光源的光紋

光紋會干擾正常視覺，長時間閱讀使用會產生不適，使用 Focal Diffuser 光學膜，均勻化點光源後，降低多重投影的光紋產生，如 FIGURE 3 所示。

B. Eliminate Multiple Shadows Of LED

Multiple shadows will interfere with man's eye sight, and cause uncomfortable feeling while reading for a long time. After using Focal Diffuser film, it reduces the multiple shadows into only one shadow, as the "FIGURE 3".



<FIGURE 3>

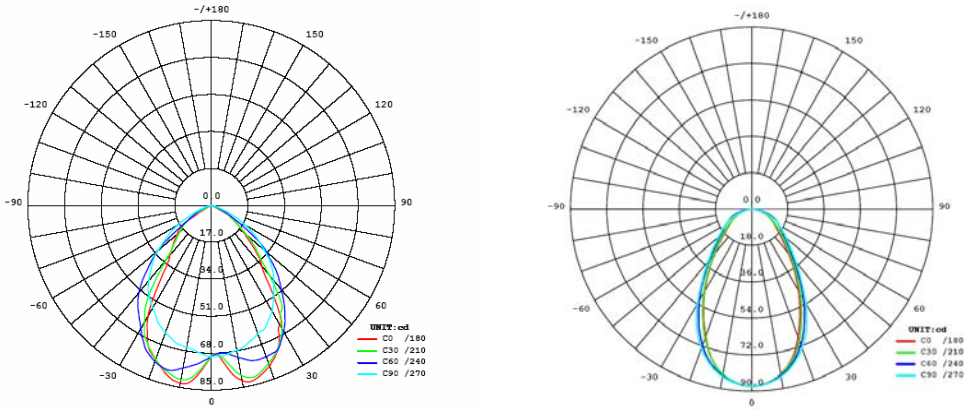
3. 超廣角擴散光型控制 ±85°(170°)

一般 LED 發光角度大約±65°(130°)之間，指向性高，只有被照面會亮且刺眼，在大角度呈

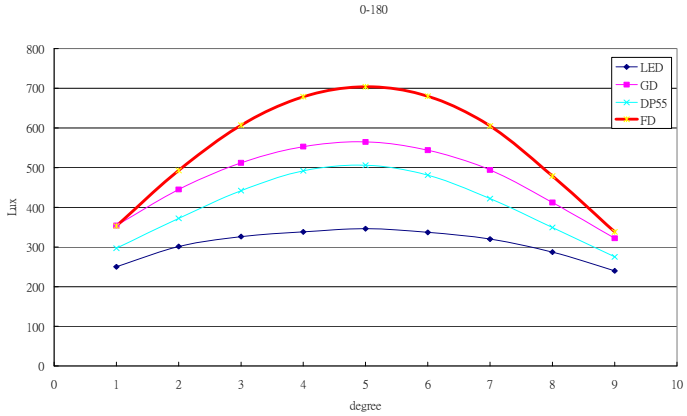
現明顯的亮暗帶。在室內照明需要廣域的照明範圍，使用 FD 光學膜不但可以將發光角度擴大到幾乎水平±85°，且無論使用何種 LED 光源，都能夠重新配光，產生高亮度且均勻的光場。<FIGURE 4> 在比較圖中可以見到，同樣的測試條件下，使用 Focal Diffuser 光學膜所量測到的照度（紅色曲線）會大幅增加。<FIGURE 5>

C. The Ultra Wide Angle Of Light Spreading ±85° (170°)

The luminous angle of Normal LED is around ± 65° (130°). It has certain diffusion angles for the light radiated from it, and only the shined side will be bright and dazzling; therefore, shows obviously bright and dark in super-wide angle. Indoor lighting need wider lighting area, using FD film can provide much wider angles – almost ±85° (equal to 170°). Whatever kinds of LED you use, they can redistribute the light and illumination completely and evenly. <FIGURE 4> We can see the comparative graphics as below (in the same test condition). – The intensity of illumination (red curve) is increasing substantially. <FIGURE 5>



<FIGURE 4> Normal LED Spread Angle / Expanding The Spreading Angle And More Concentration For The Redistribution Of Illumination After Using Focal Diffuser



<**FIGURE 5**> The Chart Of Using FD Film™ To Strengthen LED Illumination

4. 不改變 LED 色溫

不影響 LED 本身的 CIE 色度與色溫，還 LED 燈源高演色性。

D. Do Not Change LED Color Temperature

Do not influence CIE color and color temperature of LED itself, and retrieve LED the high color performance.

5.可回收耐熱光學單一 PC 材質

光學膜採用純 PC 材料製作，可回收再利用，無添加任何不利環境的混和物（例如奈米粉體或不同材料擴散劑）。

E. Optical Level Of Single Material Polycarbonate, Reusable And High-temperature Resistance

The Focal Diffuser film is made of pure Polycarbonate and can be reused. It has no any additive or content that will damage the environment. (such as nanoparticles and any diffuser material)

工研院認證測試結果

以下資料經過權威與可靠的工研院量測中心證實，FD film™ 的光效率高達 95%。

The Result Certified By ITRI

Here below is the data verified by the authoritative and creditable organization “Center For Measure Standards ”(ITRI) , the light efficiency of Our FD film™ reaches 95% high.

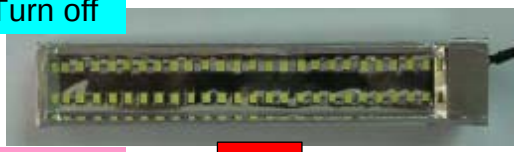
高效率 Lighting Bone ™ 使用Focal Diffuser ™光學膜比較

(High efficiency of Lighting Bone™ with and without Focal Diffuser ™)

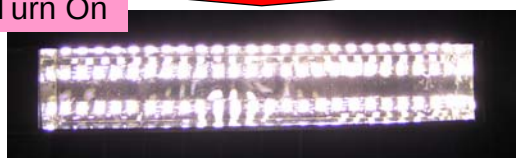
NO Focal Diffuser™

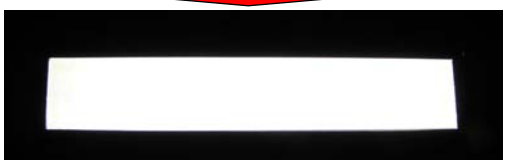
With Focal Diffuser™

Turn off



Turn On



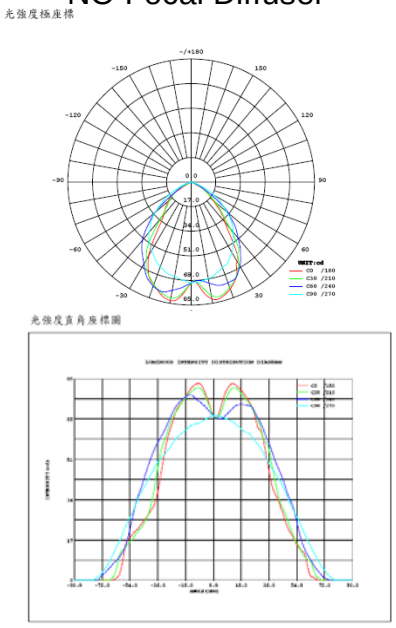


52.51m/W @ normal operation

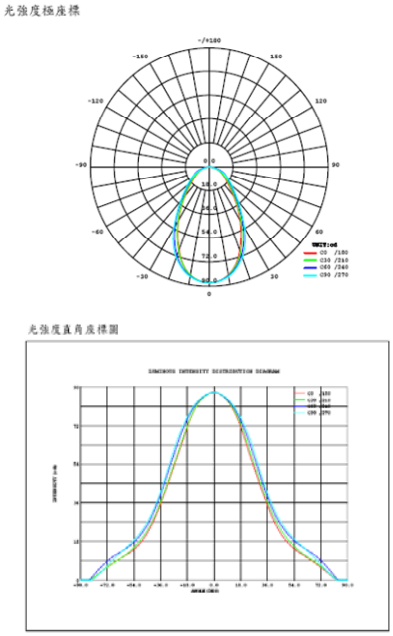
50.31m/W @ normal operation

95% Low Wastage, High Efficiency, And Uniformly Light Spread

NO Focal Diffuser™



With Focal Diffuser™



- 超廣角光源 **Wide lighting angle ±85˚(170)**
- 漸進式光強度分佈 **Smooth light intensity distribution from vertical to edge**
- 對稱性均勻光源 **Same Light intensity distribution however rotated**

委託單位：工研院量測中心光電測試實驗室　　Commission Organization ：Center For Measure Standards (ITRI)

委託測試時間：2009/4/7　　Test Time：2009/04/07

測試報告編號：09807c01099-1-3-01，09807c01099-1-1-01　　Test No.：09807c01099-1-3-01, 09807c01099-1-1-01