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HALOGEN LAMP APPLICATION IN A DAYLIGHT SIMULATOR

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Abstract: *In the engineer planning the choice of the colors in production is becoming a very important fact. In production the improvement of the quality assurance has become a great deal. Choice of the color is always made by color samples, but the control of the color is always happening by instrumental measurements. By the quality assurance of line products and by the color samples matching, instead of the devices for the color examination there are used personal controllers. For the improvement of subjective examinations we need a standard light source or a daylight stimulator. These instruments are providing standard illumination with the very expensive daylight stimulators. In MOIE's Department such a simple and cheap instrument was created and prepared (it contains halogen lamps), that with its parameters it is competitive with other more expensive similar instruments.*

Keywords: *daylight simulator, halogen lamp*

1. INTRODUCTION

The use of standard light boots is very necessary in commerce, printing industry and in color vision research. On above mentioned fields because of the cost improvement or other cases the light was used with the line power distribution.

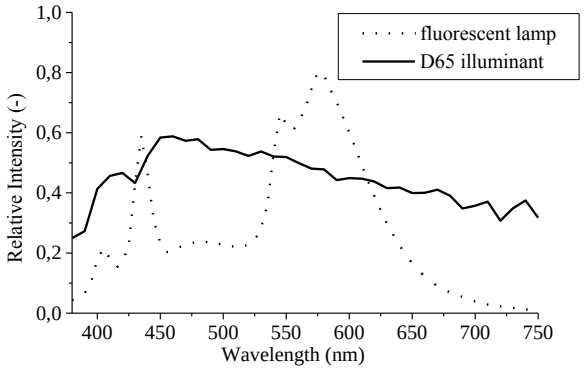

Fig. 1. Line (fluorescence) and continuous (D65) spectral power distribution light sources.

These lights (Figure 1) have small Color Rendering Index (CRI) and high Metamerism Index (MI_{vis}) [5]. These lights in commerce or their production lead to claims, in color vision research it leads to wrong diagnosis. There are modern light sources with line power distribution, whose emission spectrum came to creation in a way that their CRI is 90, but these sources by their spectral characteristics beside their good CRI number lead to wrong color identification or to low color discrimination [4].

The color samples in light boots in standard lightening examination field (Figure 2) are giving the right color sensation in the eyes of the observers and by the help of this facts they are approving the subjective color matching.

The construction of the light booths can be seen in Figure 2. The instrument contains a standard lightening simulator, which consists of one or more electronically controlled light sources and color filters. In the lightening unit there is a diffusing glass, whose act is the homogenization of the illumination on the lightening board. Illumination created on this way is constructed into a box with right geometries and right surface.

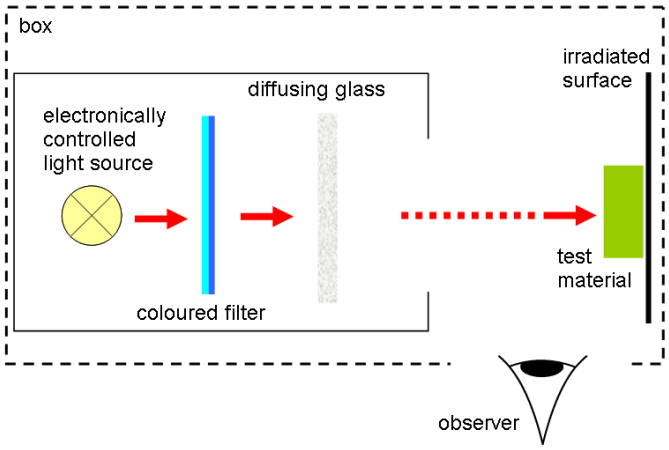

Fig. 2. The construction of the light booths

The quality of the light booth standard lightening simulators beside the spectral power distribution we can determinate with the numbers of Color Rendering Index (CRI) and the number of the Metamerism Index (MI_{vis}). The Color Rendering Index of the commercial light booths is between 80-95 and their Metamerism Index is between 0-1.5 [7, 10]. Our aim was to create a halogen lamp whose index numbers is between these numbers and is reducing the ordinary used D65 or A light simulation.

2. METHOD

The construction of the light booth can be seen on the Figure 3. This contraction quit exactly to the above mentioned functional plan. The booth was made from block board and from in and out side it is covered by non- flare neutral grey (ρ≈20 %) colored foil.

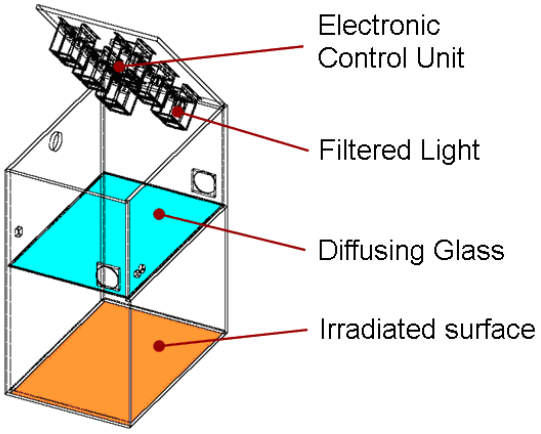

Fig. 3. The constitution of the light booth

As light sources we used 6-6 pieces of 4000 hours lasting OSRAM DECOSTAR halogen cold mirror lamps [9] with D65 and A illuminations too. Because we tried to make

compact filter and light, we put two pieces of tungsten halogen lamps, two filters and two diffusing glasses into the booth (one from each separately on A and separately on D65 simulators) we put it on an aluminum constructed board (Figure 4). This construction is the modulated construction, beside of the light replacement of the tungsten halogen lamp and the filter it provides the easy dispose of the high temperature produced by the light. The parts of the cooling system are the 2x25 W ventilators placed on both sides of the booth and the air blowing controlled latticed ventilation wholes.

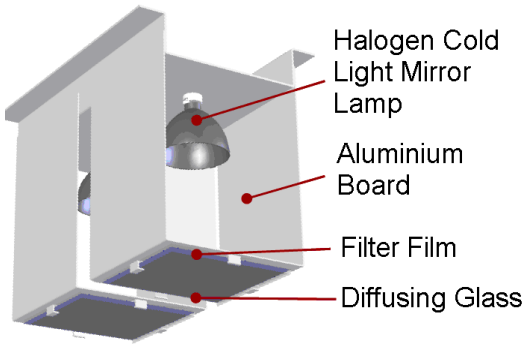

Fig. 4. Lightening modul which contains the tungsten halogen lamp, the filter and the diffusing glass

From these modules 6 pieces are on the cover of the booth, by the changing of the tungsten halogen lamp we can leave the door of the booth open. The size of the booth and the module is regarded to the geometrical characteristic of the illumination in aim to become equal lightening everywhere on the surface of the examination board [1, 2]. The external sizes of the booth are high/length/depth - 1200/1000/620 mm. The size of the examination board of the booth is: high/length/depth - 650/960/600 mm.

The filter film under the diffusing glass in the cases of A and D65 stimulators have been chosen from the LEE catalogue [8]. The choice of the filter film combination, which was put into the booth was chosen by computer optimized method. The computer optimized method took in consideration the difference between the spectral power distributions lugged with color discrimination curves, the color temperature, the CRI and the MI_{vis}.

The stabilization of the color temperatures of the tungsten halogen lamp and the switching of the lamp (A and D65) is happening electronically. The electricity feeding of the lamp because of reducing of the costs and relieving of the space is working by remote controlled switcher mechanism. The stabilization of the color temperature of the tungsten halogen lamps and for getting it to the right value has been done by the help of current generator. The control of its work is done with the help of two adjusting potentiometer built on the top of the booth. The emission characteristic which have changed with the aging of the lamps can be updated with this potentiometer (it is good to do the recalibration every 1000 hours.).

3. RESULTS

After the creation of the standard light booths, we used for the control of the nominal values some measurements [3].

The planned nominal illumination of the standard light booth on the surface of the experimental board was 1000±10% lx. The illumination created by the D65 and A stimulators we measured on 5 different points of the surface of the experimental board. From the counted ten measurements the standard value in both cases stood in 10% bearing value (Table 1).

measure point	**E (lx)**	**standard deviation**
1	995	4.85
2	962	6.87
3	1010	7.98
4	980	6.47
5	954	5.69

measure point	**E (lx)**	**standard deviation**
1	1012	4.12
2	993	3.15
3	1135	2.25
4	1075	6.52
5	1105	4.31

Table 1. Illumination on the 5 points of the table (In the case of D65 and A simulators)

We measured the color temperature and the spectral power distribution in the point no. 3. From the 10 measurement the correlated color temperature values are in Table 2. The compare of effectuated stimulators and the Spectral Power Distribution of the CIE A and D65 standard illuminants [6] can be seen in Figure 5.

	D65	**A**
Correlated Color Temperature [K]	6428	2913
CCT uncertainty [-] (99.5 % confidence int.)	± 52.5	± 33.4
Color Rendering Index [-]	82,74	97,85
CRI uncertainty [-] (99.5 % confidence int.)	± 0.25	± 0.12

Table 2. Correlated color temperature and Color Rendering Index in the point no. 3 of the board (in the case of D65 and A simulator)

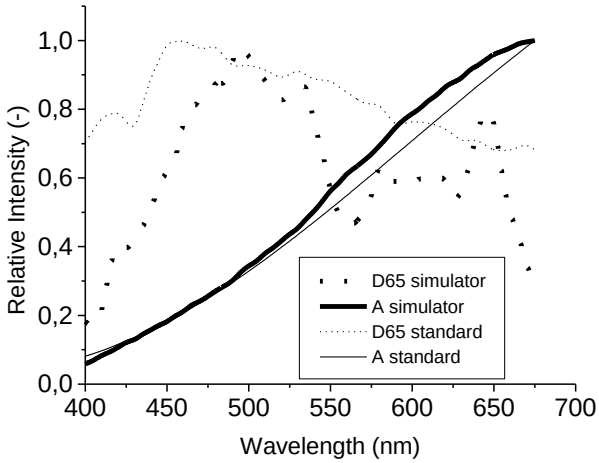

Fig. 5. The spectral comparison of the simulators and the standard illuminants (400-700 nm in the point no. 3 of the board)

Illumination simulator created on these bases has 1b color rendering degree and according to the MI_{vis} belongs to class C. These values are adequate to the parameters of the commercial booths, too.

4. SUMMARY

Lighting boots created with halogen illumination and optimized filtering method belongs to 1b color rendering index scale and has C class of the Metamer Index. These results are adequate to the expected results in the color vision researches. With the help of a daylight

simulator created by the combination of the cold halogen mirror lamp and adequate filter films we succeed to create a long durational, good quality light which is created from commercial booths and has economical price, to. The created instrument comparing with other instrument from this category is suitable for commercial, industrial use, and it is very useful for color vision researches.

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