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THE APPLICATION OF THE COMPLEX MEASURING SYSTEM – SPECTROPHOTOMETER IN SPECTROPHOTEPMETRY

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ABSTRACT
In this paper we have presented the pocedure of measuring the reflection of the light from the optical lense with a spectrophotometer. In the theoretical part, we have presented the basic elements of the measuring system and measuring equipment.
Beside the foundations of the measuring system we have shown the theoretical elements of spectrophotometr, with the special accent on reflection of the light and antireflecting layers whose measuring has been presented in the paper. Also, we have shown the procedure of the measuring of the reflection of the light on the optical lense which has been treated with a mulitple antireflecting layer using two different methods. Finally, we have given a summary and the method of the application of two software pakagings (UV WINLAB and Total ColorLight), as well as the possibility to present the different results of the mesuring by a complex measuring system – spectrophotomete, type LAMBDA 25.
Key words: technical mesuring, information measuring system**,** spectrophotometer, reflection of light

1. MEASURING SYSTEM AND EQUIPMENT
Measuring system consists of the defined group of the mesuring devices and additional equipment connected together through a channel in a functional whole and connected to the object of the measuring process, the object of the control, the object of the governing, the object of the analysis or the object of the inspection for the generating, converting, display, memorising and usage of the results (signals) in specific purposes. From this definition, we can see that the two main tasks of any measuring system are:
- Measuring of one or more of the given phisical or other elemenst and showing the results of the measuring on the analog or digital display (for direct reading), on the registrator (written or printed) or on the signalizing machine (lights, sound or display);
- Generating of the signal i.e. the information about the measuring dimensions in the shape which is appropriate for the use for other purposes (beyond the direct measuring of the dimensions) like, for example, for: automatic governing and control of the processes in the programmed systems and for the governing of many other objects and systems, memorising and keeping of the results in the given devices, and then sending of the saved information to the certain users and statistical processing of the results by a computer.

2. REFLECTION OF THE LIGHT AND INTERFERENCE OF THE THIN LAYER
When a loop of light comes to the bordering surface between the two mediums**,** one part of the light becomes reflected, while the other goes into the new medium. According to the law of reflection, the angle of the reflected ray is defined comparing the wave motion normal of the bording surface

between the two mediums. Thus, the given angle of the refeclected ray is equal to the angle which the inner ray forms comparted to the wave motion normal**.**

On the bordering surface between the two dielectrical measuring, the amplitude of the reflected light, represents the function of the relation of the index fracture two materials, the polarization of the incoming ray and the angle of the incoming ray. The intensity of the reflected and missing ray it is also the function of the incoming angle of the loop. Due to the different effects which we get when we let the loop of light it is necessary to separate the cases of inner and outer reflection. The outer reflection is related to the type of the reflection of the bordering serface when the incoming loop of light comes to the brodering surface from the area of less index of fracture (e.g. air in the cases of the bordering surfaces air-glass, air-water). The inner reflection referes to the opposite case.The thin coatings are functioning on the principles of interference. These thin layers are dielectric or metalic materials whose thickness is the same or less the wave length of the light. When the loop of the light comes to the thin layer, the part of the light is reflected from the upper surface of the layer, while one part of it becomes reflected from its lower surface, as in the figure 1. The rest of the light becomes loose**.**

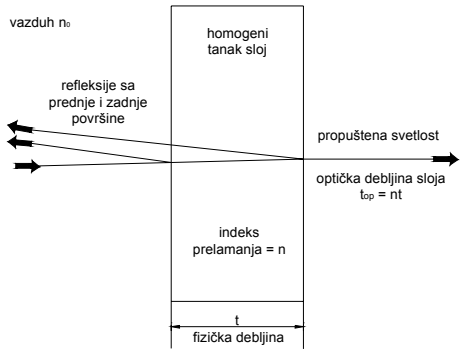

Figure 1. Reflection of the light

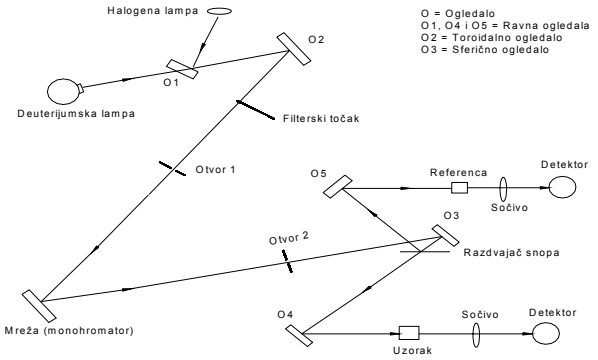

Figure 2. Optical way of light moving for Lambda 25

3. SPECTROPHOTOMETER AS A MEASURING SYSTEM

3.1 Characteristics of the spectrophotometer LAMBDA 25

Spectrometers with the label Lambda 25, 35, 45 are used for many purposes which work in ultraviolet (UV) and visible (V) part of the light spectrum and work on the principles of the total reflecting system with two loop of lights. Spectrometers Lambda 25, 35, 45 have a totally reflective optical system. The optical components are covered with a silicon layer in order to keep them working longer. In the monohromator, a holographic concave net is used with 1053 lines/mm in the center which allows the light to prelama. The optical system of the spectophotometer Lambda is shown on the figure 2.

Two sources of the radiancy**,** deuterium and halogen lams, cover the working wave length of the spectrometer. For the work in the visible part of the spectrum, the mirror O1 reflects the radiancy whose main source is the halogen lamp onto the mirror O2. At the same time, the mirror O1 blocks the radiancy which comes from the deuterium lamp. For the work in the UV part of the spectrum, the mirror O1 is lifted in order to allow the radiancy whose main source is the deuterium lamp, it comes to the tegret mirror O2. The replacement of the source of the radiancy is automatic, during the moving of the monohromator. The radiancy of the source lamp reflects from the mirror of the source O2 through the optical filter on the structure which is represented with a filter wheel. The filter wheel is operated by an engine which makes the sinchronization with the monohromator. Depending on the wave length of the produced light, on the loop of the light the appropriate optical filter is put which does the filtration of the radiancy before it comes to the monohromator. The replacement of the filter is automatic, during the monohromator moving. From the optical filter, the radiancy goes through the slot (Opening 1) of the monohromatora. The radiancy is then dispersed through the net in order to make a spectrum. Then, with a rotating net, we effectively select the part of the spectrum which is

then reflected through the slot (Opening 2) on the mirror O3.The output limits the part of the spectrum on the part of the spectrum on the monohromatic loop.
The slot allows the loop to enter, from 1 nm to Lambda 25, and in case Lambda 35 or 45we can choose from the velues from 0.5, 1, 2 or 4 nm. From the mirror O3, the radiancy is reflected onto disolver of the loop which allows that 50 % of the radiance goes onto the mirror O4, and for the rest 50 % zračenja goes to the mirror O5. The mirror O4 focuses its loop in the mirror cell. The loop then goes through the convex lenses on the photo-diodic detector. The mirror O5 focuses the loop on the appropriate cell. The llop then goes onto the photo-diodic detector.

3.2. UV WINLAB software for LAMBDA series

Lambda software gives a new dimension to the sistematic work and presenting of the given results. This software combines the widely used Windows operating system with the adjustability and potentials of Lambda spectrophotometer. It is constructed to meet the needs of the contemporary lab work in accordance to ISO 9001, which makes the measuring accurate, the report thorough, and the application of the report safe, as well as the safety of the applied analytic procedure. It is easy to use and it has simple and precise steps of the spectroscopic manipulation of the data, quantitative analysis, kinetics and validation of the instrumentation. The user has two types of the application, SCAN or CONCENTRATION. After the type of the application has been chosen, it is necessary to input the needed parameters and just run the application by pressing the start.

4. THE APPLICATION OF THE SPECTYROPHOTOMETER WHILE MESURING IN SPECTROPHOTOMETRY

In the next experiment we have presented how to measure the reflection of the light on the surface of the plastic lenses treated with HMC 10 +10 (Hard Multi Couting) layer. HMC 10 +10 consists of hydrophobic layer which does not need to be cleaned if it gets foggy; also there is a hard layer for lessening the options of the mechanical damages of the lenses, and of the multilayer antireflection layer. Index fractureof the used lenses is 1,50 and the base curve is 4, and it is made of plastic.
The reflection of the light is measured by the Perkin-Elmerovim Lambda 25 spectrophotometer, connected to Dell PC (Fig. 3) and by using two software programs. The first software solution was provided by a company Satis which manufactures the chambers for the antireflection layers. In their MC LAB 380 and the camber we have treated the lenses used in the experiment.

Figure 3. MC LAB 380 chamber and Lambda 25 and Dell PC

4. 1 Measuring of the reflection with using certain lenses

The first program used for the measuring of the reflection is called Total Color Light and it works like this: at the beginning of the program it is needed to enter the number of the chamber, and then to input the type of the material of the lenses, in this case, plastic. Then, a method of measuring is chosen, in this case, we are doing the measuring comparing with the standard reference. After that, the value of the base curve is put, and thus all the parameters are given, and the machine is ready to finish the automatic adjustment. Finally, the lenses is put into the spectrophotometer, Fig. 4:

Figure 4. Assembly of the lenses in spectrophotometer

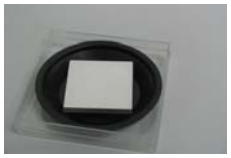

Figure 5. Mirror usage, 100% of reflectivity

The lenses in the core have three points of leaning, and the reflection of the one surface is measured. The measuring of the lenses is done, and then the lenses are removed and the new lenses whose reflection is measured, is put. We get the curve in which we get the reflection, and we measure the reflection of the lenses. The next step is picking one curve which was done earlier, and comparing the differences, if they are in the allowed limits. The program has the possibility to present the results in different ways.

4. 2. Measuring of the reflection by a mirror 100% of reflectivity

The second program of the company Perkins Elmer called UV Win lab does not depend on the base curve of the lenses, and uses mirrors (as a reference) with 100% of reflectivity. Firstly, we choose the type of the measuring, in this case, reflectivity, then, the wave length and its pace, then the mirror and then the sample.

The sample is grinded from the back and colored black in order to avoid the reflection from the back surface. The result is shown in the figure 6.

5. CONCLUSION

Spectrophotometer apart from the presented measuring, is widely used for: measuring chemical characteristics of the materials, temperature measuring etc. All of it is done with high precision. tipa Spektrophotometers type LAMBDA are complex systems of the top up-to-date equipment. They belong to the group of the high quality systems due to the fact that they include measuring and computing technique at the same time. This complex is capable of doing these things: measuring and control of the quality elements, processes, paremeters of the states and stages, their display, and mathematical processing of the results in the real time, memorising the results, transmission of the results from one to another place through the appropriate communicative lines, printing the results, quality assurance and check.

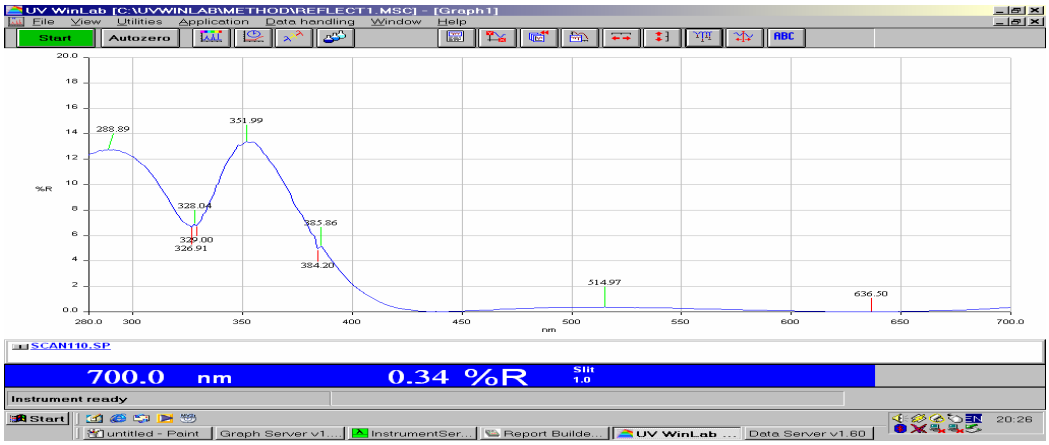

Figure 6. Result of the measuring

The production and development of the spectrophotometer type LAMBDA, was the result of the need to solve two basic tasks in the contemporary metrology. The first refers to the increase of the number of metrology operations and programs, and with the biggest level of automatization.

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