DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

Looking at the history of progress made in materials science over the recent years, it is clear that the use of electroluminescence phenomenon, which is based on light emission by the substance under the applied voltage, is becoming increasingly popular. An example here are OLEDs (organic light-emitting diodes), in which the emitting layer is an organic polymer. This layer is located between two electrodes, of which at least one is transparent, so that the light emitted by the diode can cross it. OLEDs are frequently used to produce displays applied in mobile phones and other mobile devices, as well as in TV sets and monitors. The principle of operation of an OLED is similar to a standard light-emitting diode (LED), namely, the conversion of electricity into radiation of a specific wavelength that the human eye receives as a color. However, unlike other light sources, displays made of OLEDs are highly flexible, thin and flat, what enables creation of displays with curved surfaces. Compared to LCDs (Liquid-Crystal Display), additional advantages of OLEDs are: short response time, wide viewing angles, excellent contrast and brightness. However, the excellence of OLEDs at the present moment is quite questionable, because of the interactions of diodes with water vapor and oxygen in the air, which lead to reduction of their performance and longevity. For this reason, they have become the focus of intense research in the direction of counteracting this problem. However, as of today, no method has been able to provide them satisfying protection from degradation processes. A promising solution here is the use of thin film technology. The development of new thin film technology, which would ensure high homogeneity and density of the layers, their good adhesion to the substrate, low transport rates of water vapor and oxygen within them, and their long-term thermal stability, may allow advances in technology and production of OLEDs and flexible displays in the future. Currently, a number of layers from different systems is considered for the application in OLEDs, as well of number of different deposition techniques. Unfortunately, none of them has been used in mass production due to the complexity of deposition processes, their long times and / or high deposition temperatures. Therefore the need for further studies on the thin film technology for application in OLEDs is still urgent.

The main aim of the project is to obtain and study the properties of single layers, as well as new hybrid layers from Si-C-N-H system, for application in organic OLEDs. The layers will be deposited with use of radio-frequency plasma assisted chemical vapor deposition method (RF-PACVD). The choice of the RF-PACVD method is dictated by its low temperature deposition, which, in the case of OLEDs, is crucial for preserving the stability of the organic compounds. Single layers and SiN_x:H/CN_x:H and $SiCN_x$:H/CN_x:H multilayers systems will be obtained and tested. Such layers will be optimized in terms of the number of layers, their thicknesses and chemical compositions, to provide optimum performance in intended applications, namely barrier properties for water vapor and oxygen. In addition, current-voltage-electroluminescent characteristics will be determined. Also, the proposed scope of research will expand the knowledge of characterization of optical properties of layers, including hybrid layers.