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PRACA DOKTORSKA

Badanie morfologii i własności fizycznych cienkich warstw poliazometin

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ABSTRACT

This doctoral thesis shows that physical properties and morphology of thin polyazomethine films can be changed by controlling of technological parameters of preparing method, by incorporating of additional atoms into the polymer backbone and with use of dopants.

Technological parameters (intensity of gas stream and temperatures of monomer sources) distinctly influence thin polymer films growth rate. Parameters were changed to determine growth rate of PPI thin films and to observe their impact on UV-Vis absorption spectra and morphology images. Increasing of gas stream intensity and monomer's temperature results in growth rate increasing to maximum value till stoichiometric ratio of monomers concentrations is nearly balanced. An influence of the film growth rate increase on the UV spectra is connected with shift of lowenergy band due to electron interband transitions linking delocalized states towards lower energies. Additionally in morphology of thin films obtained with higher growth rate big grains and holes have appeared.

Incorporating of oxygene atom into the polyazomethine backbone has limited the length conjugated fragments and the conjugation is reached maximum onto three benzene rings. The presence of oxygen atom in the polymer backbone caused change of polyazomethine conformation – the polymer chain is more twisted and polymer structure is more amorphous. The lowenergetic absorption band in UV-Vis absorption spectra has shifted to higher energies. This results in broadening of polyazomethine energy gap.

The doping of polyazomethines was managed by applying of iron (III) chloride and iodine dopants. Doping with use of iron (III) chloride was providing during polycondensation process and doping with use of iodine was realized by keeping of prepared samples in iodine atmosphere. Doping with use of both of dopants caused that benzenoidal form has transformed to quinoidal one. The positive polaron states are appeared in polymer's energy gap and this effect has been observed in UV-Vis spectra as broadening of absorption band. That means that doping with use of iron (III) chloride and iodine is p-type.

The possibility of polyazomethine properties controlling leads to potential application of this material in industry as active layers in photovoltaic structures such the organic light emitting diodes (OLEDs) and organic solar cells.