Structure and properties of poly(9-vinylcarbazole) thin compositional nanofilms

G.B. Melnikova[1,2], D.V. Sapsaliou[2], V.A. Lapitskaya[1], T.N. Tolstaya[1], T.A. Kuznetsova[1], S.A. Chizhik[1], A.V. Luikov[1]
[1]Heat and Mass Transfer Institute of NAS of Belarus, Minsk, Belarus, e-mail: galachkax@gmail.com
[2]Belarusian State Pedagogical University named after Maxim Tank, Minsk, Belarus

The morphology of thin compositional films and careful control of the ratio of the composite components play a crucial role in regulation the processes of charge transfer and optimizing theirs optoelectronic properties.

Compositional poly(9-vinylcarbazole) (PVC, $M_w \sim 1\ 100\ 000$) films with silicon dioxide nanoparticles were obtained from a mixture of PVC and a powder of nanoparticles (NP) SiO_2 (d=10− 20 nm) as NP suspension in chloroform with different volume ratio (1 mol PVK : $0.67 \cdot 10^4$ and $167 \cdot 10^4$ mol SiO_2 respectively.

It was found, that the optimal concentration is of 0.5 mg/ml and surface pressure for forming PVC-films by Langmuir – Blodgett method is varied from 4 to 12 mN/m (Fig. a, b). After incorporation of NPs in a chlorophorm suspension and as powder surface pressure of phase state of the solid film is shift to the value pf 30 mN/m, while the NPs are embedded in the structure of the PVC film. In the case of SiO_2 powder NPs directionally structured layer (Fig. c, d).

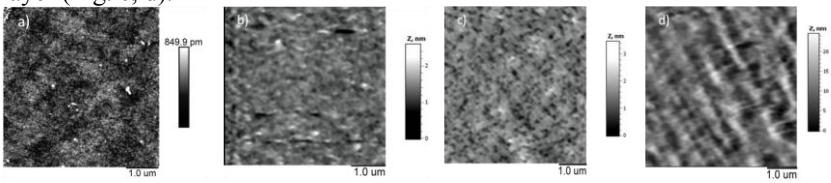

Fig. AFM-structure of PVC films on silicon substrate:
a) PVC, π = 4,7 mN/m; b) PVC, π = 8,3 mN/m; c) PVC + SiO_2, π = 30 mN/m;
d) PVC + NPSiO_2, π = 33 mN/m

Contact angle doesn't depend on structure and composition of film and its value is only 59^0 on silicon substrate. On the glass substrate structure of films is denser and CA increases to the value of 70^0 and in the case of composition films PVC+NP SiO_2 is up to 92^0. For films formed by spin-coating method the surfaces are characterized by conglomerates with sizes from 200 to 400 nm and CA is of $70-85^0$ on the two types of substrates. These films don't reduce the light transmission of glass and increase scattering in some cases.