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PREPARATION OF TRANSPARENT ELECTRODES BASED ON CNT-S DOPED METAL OXIDES

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In recent year's electrically conductive and transparent electrodes have been one of the most important issues in optoelectronics. The field of applications of these electrodes varies from solar cells to different displays etc. Increased need for transparent electrode material indium tin oxide (ITO) has raised the price of its main component indium around 10 times since the year 2000. That's why the search for alternative materials is of great interest. Because of their unique properties, CNT-s have been used as dopants to improve electrical and mechanical characteristics of different transparent materials, in order to create new electrode materials [1]. As probably the cheapest option, the main materials tested as matrixes are different organic polymers [2]. Still, these materials have some drawbacks compared to ITO, like lower chemical and mechanical stability.

To overcome these problems we have started studies to design electrodes based on high refractive index transparent metal oxides like TiO_2 and SnO_2, which are among the most stable compounds. As these materials also have high hardness, they are often used as protective layers [3]. In our experiments sol-gel method was used for preparation of these materials [4]. CNT-s were added to the precursor sol in proper organic solvents assisted by sonification. After baking up to 340°C in air, dense oxide ceramics, doped by aligned nanotubes, were achieved in shape of fibers or films. Suitable high viscosity precursors for fibers pulling were obtained by concentrating oligomeric sol solutions. Films were prepared by spin-coating or dip-coating.

SEM images of fibers proved that pulling process aligned CNT-s in the material. Prepared materials were transparent and electrically conductive up to 500 S/m. Electrical conductivities were measured by 4-point method.

Our experiments revealed that CNT-doping could notably improve the electrical properties of the material without seriously affecting its transparency.

References

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