Feasibility Project

DEVELOPMENT AND MANUFACTURE OF TRANSPARENT, ELECTRICALLY CONDUCTIVE, FLEXIBLE PLASTICS

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The world of electronics is progressing at fast speed, continuously increasing its requirements for smaller, faster, lighter and cheaper electronic components and systems, and materials that may cover small or large and complex-shaped areas, might be used in a multi-functional role and need be easily processable and recyclable. Transparent, electrically conductive, 3D compliant plastics are expected to become key materials in optoelectronics, smart materials and energy applications, such as solar cells. They are the center of the vision for the next generation smart, flexible displays, electronic paper, e-textiles, shape memory applications and smart windows.

Materials with surface resistivity of 10 – 100 ohm/square could be considered for the manufacture of transparent, electrodes. We have prepared doped forms of polyaniline and polythiophenes with such high electrical conductivities. Such polymers have even higher electrical conductivity when they are oriented, which might be achieved when they are extruded in fibre form that could be used in applications involving textiles or fibrillar membranes. An important issue to be considered in such polymers is that they are hole carriers and, hence, they need be combined with an electrolyte in liquid or solid state. Another application for polyaniline and polythiophenes is their use in photovoltaic cells and two such cells manufactured in this project will be discussed in this presentation.

Materials with surface resistivity of the order of kilo to mega ohms/square are still considered as electrically conductive. We have carried out intensive investigations of manufacturing nanocomposites of carbon multiwalled nanotubes in elastomeric matrices, aiming at lowering the percolation limit in order to obtain transparent, electrically conductive nanocomposites. An important finding was that such nanocomposites with surface resistivity of the order of kilo ohms/square also exhibited very high dielectric constants and exhibited actuating behaviour of the bending mode type. Research in this area still continues with suitable functionalisation of nanotubes to facilitate their dispersion and further increase the transparency and electrical conductivity of the resulting nanocomposites.