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NOVEL STRATEGY FOR THE PRODUCTION OF NANO-OBJECTS COMBINING SUBMERGED NANOCONTACT PRINTING AND ELECTROPOLYMERIZATION OF POLYPYRROLE

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Conducting polymers display interesting properties (electrical, electronic, magnetic, etc.) that make them interesting and important for scientific and technological applications. The switching capability of these materials between oxidized (doped) and insulating reduced (undoped) state is the basis of many of such applications. The fixation of specific receptors over the polymer film provides a controlled method for detection of biological molecules over an electrode for biosensing applications. Electrochemically produced polypyrrole (Ppy) is one such conducting polymer [1-2]. For applications such as array production for biosensing, a thin, continuous polypyrrole layer is inappropriate as conduction from the arrayed sensing elements will be dissipated throughout the bulk of the polymer layer. Therefore, some method is required for the specific targeting of well-defined areas of polypyrrole, which can be used as individual conducting elements for sensor array systems.

Positional control of the growth of polypyrrole has been achieved by using a combined method of submerged micro&nanocontact printing [3] and surface functionalisation prior to the electrochemical growth of the polymer. Electrochemically produced Ppy [4] incorporates doping anions to compensate the positive charges on the polymer chain generated during polymerisation to maintain the conductive nature of the polymer. Cobaltabisdicarbollide ($Co(C_2B_9H_{11})_2]^-$) was used as doping anion and Ppy-[$Co(C_2B_9H_{11})_2$] microstructures have been produced by directed, potentiostatic electropolymerisation using a patterned combination of conducting (4-aminothiophenol) and insulating (octadecylmercaptan) thiols [5]. The different conducting characters of both SAMs guides the PPy-[$Co(C_2B_9H_{11})_2$] deposition over the pattern. In this way we have produced doped, nanostructured annular polypyrrole rings (figure). The physical/chemical processes that affect the polypyrrole growth and the effects of different doping anion were studied.