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OPTIMIZATION OF SURFACE MODIFICATION OF POLYMER SUBSTRATES BONDED TO PDMS FOR THE DEVELOPMENT OF MICROFLUIDIC SYSTEMS

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Microfluidic systems is one of the most interesting technic used nowadays to study fluidics proprieties at micrometric scale especially for medical fields and biological applications. The elastomeric polymer Poly(dimethylsiloxane) also knowne as PDMS, is widely used almost for all manufactured microfluidic systems, and has become an important material for biomedical applications. Furthermore due to its biocompatibility, PDMS has several important proprieties such as its permeability, elasticity, good thermal stability and low surface tension [1].Bounding PDMS with polymer substrates to make functional microfluidic system is the principal problem of PDMS-polymer adhesion. To address this challenge, in this paper a new technique is presented in order to decrease fabrication time, cost, as well as many other process stages to manufacture microfluidic channels on polymer substrates.

Biocompatible polymers used in this paper are polyimide (PI), polyethylene naphtalate (PEN), and polyethylene tetraphtalate (PET). These three polymers are chosen for their many attractive material proprieties, such as their excellent thermal and mechanical stability, high chemical resistance, and good optical proprieties [2-3].

The PDMS was bonded on polymer substrates (PI, PEN and PET) by Si-o-Si bonding between inorganic silane groups of PDMS and silane groups which have been chemisorbed on polymers surfaces by 3-mercaptotrimethoxisilane (3-MPTMS) treatment, and followed by oxygen plasma treatment. The PDMS was oxidized then by oxygen plasma to generate -OH group on its surface and brought immediately after plasma treatment on the surface of the treated polymers. The adhesion between polymers-PDMS was defined first by concentration of 3-MPTMS, and the time of oxygen plasma treatment of PDMS and 3-MPTMS polymers treated.

Contact angle measurements were made to ensure that 3-MPTMS is chemisorbed on the polymers surface. The contact angles of the normal polymers and 3-MPTMS treated polymers were measured using dionised water. The measurements were repeated ten times for each substrate. Infrared FTIR, and ToF-SIMS characterization were made to show the chemical structure on the surface of the three polymers after treatment, and to predict the nature of the chemical bonding between PDMS and the polymer.