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What is claimed is:

1. A microfluidic device having a temperature responsive polymer and a conductive fluid comprising,

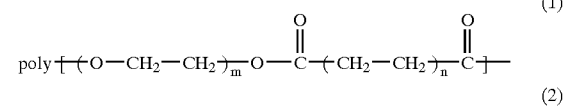
45 a substrate bearing a grafted temperature responsive polymer thereon,

electrodes in contact the substrate so as to contain a conductive fluid therebetween, a microchannel grid in contact with the substrate whereby micro channels of the grid face the substrate and cover the electrodes to

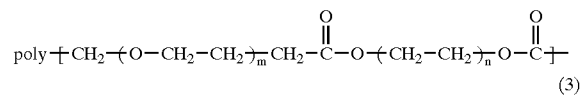
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confine the conductive fluid to the microchannels, wherein the grafted polymer comprises one of the following polymers:

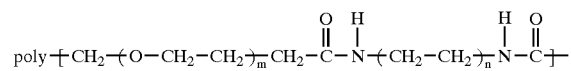
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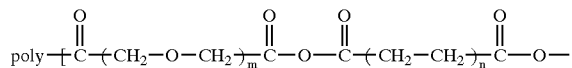
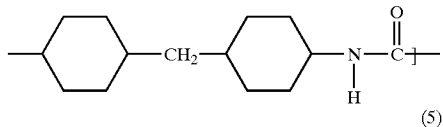
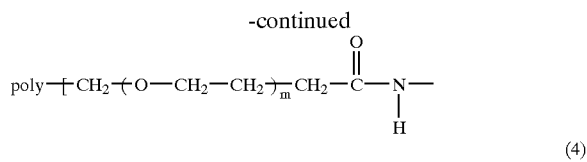
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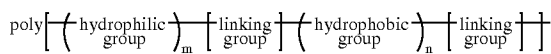
wherein $1 \leq m \leq 30$ and $1 \leq n \leq 30$.

2. The device of claim 1 wherein the conductive fluid comprises methylene blue.

3. A temperature sensitive, water soluble polymer that has a lower critical solution temperature of from about 7° C. to about 70° C., wherein the monomeric unit of the polymer contains a number (m) of hydrophilic organic groups and a number (n) of hydrophobic organic groups, connected via organic linking groups.

4. The temperature sensitive polymer of claim 3, where the hydrophilic group is ethylene oxide and the hydrophobic group is ethylene.

5. The temperature sensitive polymer of claim 3, wherein the polymer has the formula:



wherein the number of hydrophilic groups (m) is between 1 and 30, and number of hydrophobic groups (n) is between 1 and 30.

6. The temperature sensitive polymer of claim 3, where the hydrophilic and hydrophobic groups are randomly placed along a linear polymer molecule with the same ratio m/n and are not clustered in hydrophilic-only or hydrophobic-only sequences with more than 30 homologous (hydrophilic or hydrophobic) groups in each sequence.

7. An aqueous composition, comprising: a water soluble polymer of claim 3.

8. The aqueous composition of claim 7, wherein the hydrophilic component of the water soluble polymer is selected from the group consisting of: ethylene oxide, methylene oxide, vinyl alcohol, acrylamide, acrylate, propylene oxide, acrylic-acid, methacrylic-acid, and methyl-acrylic-acid.

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9. The aqueous composition of claim 7, wherein the hydrophobic component of the water soluble polymer is selected from the group consisting of: ethylene, or propylene, or isobutylene, C4-C10 cycloaliphatic, cyclopropane, cyclobutane, cyclopentane, cyclohexane, furan, vinyl groups, acrylonitriles, methyl-methacrylate, semi-inorganic acrylic, aromatic groups, benzene, phenylene, carbohydrates, amylose, cellulose, cellulose nitrate, diene groups, butadiene, chloroprene, isoprene, norbornene, anhydride groups, DNA/RNA bases, ester groups, ether groups, ketone groups, sulfone and ether sulfone groups, nitrile groups, peptide groups such as protein groups, alanine, glutamate, collagen, gelatin, glycine, and lysine, saccharide groups, silane groups, methyl-phenyl-silylene, mono-alkyl- and di-alkyl-silylene, silazane groups, silazane, mono-alkyl- and dialkyl-silazane, vinylidene chlorides, vinylidene fluorides, isobutylene, multi-fluoro- and multi-chloro-alkenes, and fluoropolymer groups, tetrafluoro-ethylene, perfluorinated and semifluorinated ethers, fluoro vinylidenes, perfluorinated and semifluorinated aromatic rings, perfluorinated and semifluorinated C4-C10 cyclo aliphatics.

10. A method of controlling the lower critical solution temperature (LCST) of a water soluble polymer that has an LCST of from about 7° C. to about 70° C. in water, wherein the polymer is made from a ratio m/n of (m hydrophilic organic groups)/(n hydrophobic organic groups), connected via organic linking groups, the method comprising:

controlling the LCST temperature sensitivity by varying the m/n ratio, while maintaining the polymer microstructure of a linear chain and avoiding clustering in hydrophilic-only or hydrophobic-only sequences with more than 30 homologous (hydrophilic or hydrophobic) groups in each sequence.

11. The method of claim 10 comprising controlling the LCST temperature sensitivity by varying the m/n ratio, while avoiding clustering in hydrophilic-only or hydrophobic-only sequences with more than 30 homologous (hydrophilic or hydrophobic) groups in each sequence and maintaining a mostly linear polymer microstructure with short branches, wherein the branches are not hydrophilic-only or hydrophobic-only sequences and the polymer backbone is not a hydrophilic-only or hydrophobic-only sequence.

12. The temperature sensitive polymer of claim 3, wherein the hydrophilic and hydrophobic groups alternate.

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