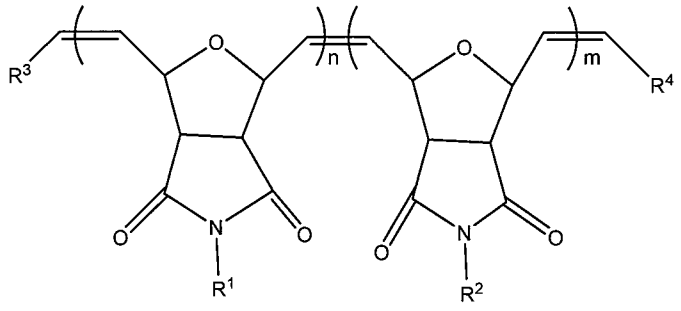
CLAIMS:

1. A method of preparing a self-assembled structure comprising a diblock copolymer of the formula (I):



(I),

wherein:

R^1 is a poly(alkyleneoxide) group of the formula, $-(CHR-CH_2-O)_p-R'$, wherein p = 2-6, R is H or methyl, and R' is H, a C_1-C_6 alkyl group, or a C_3-C_{11} cycloalkyl group;

R^2 is a C_6-C_{20} aryl group or a heteroaryl group, optionally substituted with a substituent selected from hydroxy, amino, halo, alkoxy, alkylcarbonyl, alkoxycarbonyl, amido, and nitro;

one of R^3 and R^4 is a C_6-C_{14} aryl group, optionally substituted with a substituent selected from hydroxy, halo, amino, and nitro, and the other of R^3 and R^4 is a C_1-C_{22} alkoxy group, optionally substituted with a substituent selected from carboxy, amino, mercapto, alkynyl, alkenyl, halo, azido, and heterocyclyl; and

n and m are independently about 10 to about 2000;

wherein the volume fraction of the monomer bearing R^2 to that of the monomer bearing R^1 in the block copolymer is about 3.5:1, and the self-assembled structure has a cylindrical morphology;

the method comprising:

(i) dissolving the diblock copolymer in a solvent system to obtain a polymer solution;

(ii) spin coating the polymer solution onto a substrate;

(iii) annealing the coating obtained in (ii) to obtain a self-assembled structure; and optionally

(iv) washing the self-assembled structure obtained in (iii).

2. The method of claim 1, wherein R is H.

3. The method of claim 1 or 2, wherein p is 3-6.

4. The method of any one of claims 1-3, wherein R' is a C_1-C_6 alkyl group.

5. The method of any one of claims 1-4, wherein R' is methyl.

dichloroethane, dimethylformamide, dimethylacetamide, N-methylpyrrolidone, dimethylsulfoxide, tetrahydrofuran, 1,3-dioxane, and 1,4-dioxane.

13. The method of any one of claims 1-12, wherein the polymer solution contains about 0.1 to about 2% by weight of the diblock copolymer.

14. The method of any one of claims 1-13, wherein the substrate is selected from glass, silicon wafer, metal plate, plastic film, and a plastic film coated on a glass substrate or on a silicon wafer.

15. The method of any one of claims 1-14, wherein the substrate is porous.

16. The method of any one of claims 1-15, wherein the annealing is carried out in the presence of a solvent vapor.

17. The method of any one of claims 1-16, wherein the diblock copolymer in the self-assembled structure has a cylindrical morphology perpendicular to the plane of the self-assembled structure and the self-assembled structure has pores whose diameters are in the range of about 40 to 60 nm and the pores extend all the way down to its thickness and to a depth of about 50 nm.