CLAIMS

1. A composition comprising:

a random copolymer having structure (D), comprising:

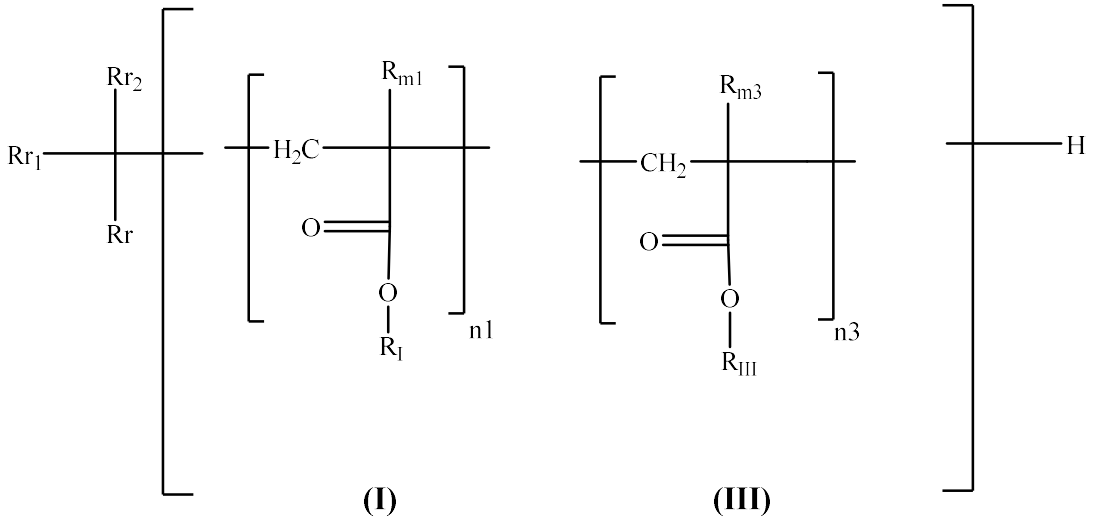
an alkyl bearing repeat unit of structure (I), wherein R_I is a C-1 to C-8 alkyl, R_{m1} is H or a C-1 to C-4 alkyl, and n1 is the total number of repeat units,a crosslinking repeat unit of structure (III), wherein R_{m3} is H or a C-1 to C-4 alkyl, and R_{III} is a moiety of structure (A-2), wherein Rs_1 is a C-1 to C-4 alkyl, Rs is a C-1 to C-4 alkyl, x is 0, 1 or 2, and L_2 is either a direct valence bond or a C-1 to C-10 alkylene moiety and n3 is the total number of repeat units,

two end groups as shown in structure (D), one of which is H and the other is a methyl moiety substituted with Rr, Rr_1 and Rr_2, wherein Rr_1, and Rr_2 are independently selected from a C-1 to C-8 alkyl and Rr is a cyano moiety (-CN) or a carbonylalkyl moiety (-C(=O)-Ri), where Ri is a C-1 to C-8 alkyl or an aryl moiety;

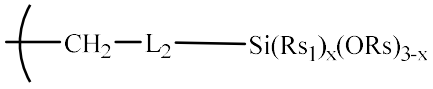
at least one crosslinker of structure (B), wherein;

L_5 is a C-4 to C-8 alkylene which has a length of at least 4 carbon atoms, R_{a1}, R_{a2}, R_{a3} and R_{a4} are independently selected from a C-4 to C-8 alkyl; and

a spin casting organic solvent;

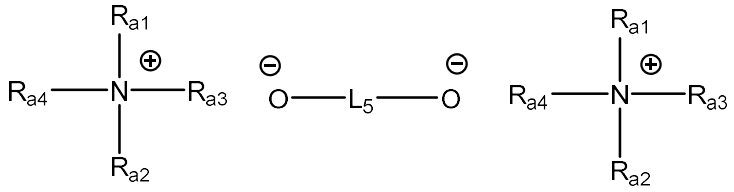


(I) **(III)**



(A-2)

(D)



(B).

2. The composition of claim 1, wherein said copolymer of structure (D) consist essentially of repeat units of structures (I), and (III).

3. The composition of claim 1 or 2, wherein said copolymer of structure (D) consist of repeat units of structures (I), and (III).

4. The composition of any one of claims 1 to 3, wherein R_{m1} is methyl.

5. The composition of any one of claims 1 to 3, wherein R_{m1} is H.

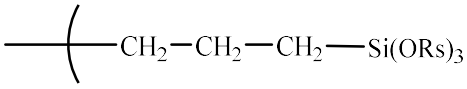
6. The composition of any one of claims 1 to 5, wherein in structure (A-2) x is 1.

7. The composition of any one of claims 1 to 5, wherein in structure (A-2) x is 2.

8. The composition of any one of claims 1 to 5, wherein in structure (A-2) x is 0.

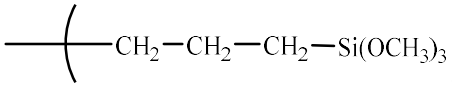
9. The composition of any one of claims 1 to 8, wherein L_2 is a C-2 to C-4 alkylene moiety.

10. The composition of any one of claims 1 to 9, wherein R_{III} has structure (A-2a);



(A-2a).

11. The composition of any one of claims 1 to 10, wherein R_{III} has structure (A-2b);



(A-2b).

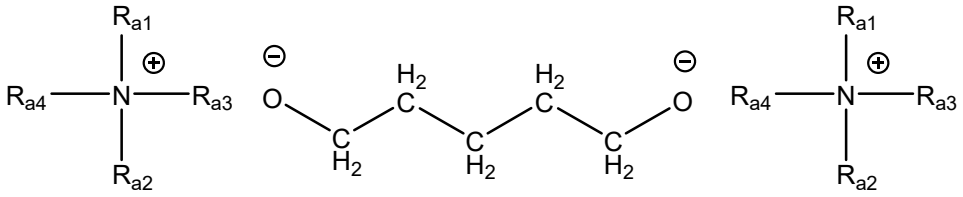
12. The composition of any one of claims 1 to 11, wherein R_{m3} is methyl.

13. The composition of any one of claims 1 to 11, wherein R_{m3} is H.

14. The composition of any one of claim 1 to 13, wherein, in the polymer of structure (D), the mole % of the repeat unit of structure (I) ranges from 70 mole % to 90 mole %, and the mole % of the repeat unit of structure (III) ranges from 5 mole % to 30 mole %, and further where the total of the mole % of the repeat unit of structures (I), and (III) equal 100 mole %.

15. The composition of any one of claims 1 to 14, wherein in said crosslinker of structure (B), L_5 is a C-4 to C-6 alkylene.

16. The composition of any one of claims 1 to 15, wherein said crosslinker of structure (B) has structure(B-1),



(B-1).

17. The composition of any one of claims 1 to 16, comprising 0.2 wt. % to 2.0 wt. % of said copolymer, 0.02 wt. % to 0.04 wt. % of said crosslinker, and 98.0 wt. % to 99.8 wt. % of said spin casting organic solvent, wherein the sum of these wt. % ranges equals 100 wt. %.

18. A process of forming a crosslinked pinning film comprising the steps:

id) coating the composition of any one of claims 1 to 17 on a substrate,

iid) baking in air at temperature from 230 to 250°C the coated substrate for 30 sec to 3 min, to crosslink,

iiid) rinsing with a rinse solution for 1 to 4 minutes, to remove any soluble material,

ivd) drying the coating forming said crosslinked pinning layer on the substrate.

19. A process for directing a multiplied pattern in a block copolymer film, said process comprising:

ie) providing a block copolymer having two or more spontaneously separating blocks,

iie) providing a substrate,

iiie) forming a crosslinked pinning layer according to claim 18; and,

ive) disposing the block copolymer on at least a portion of said crosslinked pinning layer.

20. The process of claim 19 further comprising:

ve) before disposing the block copolymer, forming a pattern in crosslinked pinning layer by a lithographic process,

vie) optionally providing a second coating in the pattern wherein said second coating is a neutral layer.

21. The use of the composition of any one of claims 1 to 17 for forming a crosslinked pinning film on a substrate or for directing a multiplied pattern in a block copolymer film.