

radical initiator and may also include no accelerator, other than those discussed below. Like the etchant/primer/adhesive monomer system (A), the system (B) may employ separately packaged (i.e., in separate containers) components (B1) and (B2). The components (B1) and (B2) may each contain their own solvent systems, which are the same or are miscible with one another and compatible with the separate solutes. Where only one of the components, the etchant/primer compound(s) or the adhesive monomer(s) is dissolved in a solvent system, the solvent should be one suitable for dissolving the other components of the system.

In use, the (B) system may be used according to one of two different methods according to the present invention. Thus, the first method is identical to the method employed with the (A) system. That is, a solution of (B1) is applied to the substrate, typically dentin, and either lightly rinsed with water or left unrinsed. Thereafter, a solution of the adhesive monomer (B2) is applied to the substrate surface and polymerization and curing allowed to take place. Because of the initiating and accelerating properties of the etchant/primer compositions of the present invention, the absence of an initiator in (B2) presents no problem in rapid polymerization, particularly when highly active monomers of the type discussed above, such as those which include acid, hydroxyl, amine or quaternary ammonium groups are used, or when an activating cation is present.

In the second method of using the etchant/primer/adhesive monomer systems (B), the steps of etching, priming and forming an adhesive polymer may be accomplished in a single step. Thus, the separate components (B1) and (B2), including the substances described above, may be combined in a single solution and applied to the substrate. In this method, rather than sequentially applying separate solutions, a single solution containing the etchant/primer compound and the solvent system of the present invention as well as the monomer system, and generally without a conventional free-radical initiator, is applied as a single solution. In such an instance, either (B1) or (B2) may be solvent-free, with the other of the components containing a solvent system suitable for dissolving the solvent-free component. Alternatively, both components may include a suitable solvent system which is compatible with the solvent system of the other component.

What is claimed is:

1. An etchant/primer/adhesive monomer composition comprising:

a compound having the formula



wherein $\text{R}=\text{R}^1$ or R^2 ;

R^1 =an aromatic group;

R^2 =a conjugated aliphatic group;

Y=a single bond, CH_2 , CHCH_3 or $\text{C}=\text{CH}_2$; and

each M is independently H, an alkali metal, an alkaline earth metal, aluminum, a transition or redox metal or an alkyl group having 1 to 18 carbon atoms, with the proviso that when both M groups are alkyl groups, the compound corresponding to formula I be capable of being easily hydrolyzed, displaced, or exchanged with other reagents present in the etchant/primer composition;

a polar solvent; and

an adhesive monomer system.

2. An etchant/primer/adhesive monomer composition according to claim 1 wherein said polar solvent system comprises an aqueous solvent.

3. An etchant/primer/adhesive monomer composition according to claim 2 wherein said aqueous solvent system comprises water and acetone.

4. An etchant/primer/adhesive monomer composition according to claim 1 wherein R^1 comprises C_6H_5 or $\text{C}_6\text{H}_4\text{R}^3$, and

wherein $\text{R}^3=\text{N}(\text{CH}_2\text{CO}_2\text{M})_2$; $\text{C}_6\text{H}_4\text{N}(\text{CH}_2\text{CO}_2\text{M})_2$; $\text{O}(\text{CH}_2)_2\text{OC}_6\text{H}_4\text{N}(\text{CH}_2\text{CO}_2\text{M})_2$; $\text{CH}=\text{CH}_2$; CO_2H ; F; Cl; Br; I; OH; SH; (m- or p-) $\text{CH}_2\text{C}_6\text{H}_4$ (m- or p-) $\text{CH}=\text{CH}_2$; $\text{OCOC}(\text{R}^4)=\text{CH}_2$; $\text{NR}^4\text{COC}(\text{R}^4)=\text{CH}_2$; $(\text{CH}_2)_2\text{OCOC}(\text{R}^4)=\text{CH}_2$; C_6H_5 ; an alkyl group having 1 to 12 carbon atoms; HOCH_2 ; HOCH_2CH_2 ; R^5_2N ; R^6O ; R^6S ; R^6CO ; R^7CONH ; R^7COCO ,

wherein $\text{R}^4=\text{H}$ or CH_3 ;

wherein $\text{R}^5=\text{H}$ or an alkyl group having 1 to 8 carbon atoms;

wherein R^6 =an alkyl group having from 1 to 6 carbon atoms; and

wherein R^7 =an alkyl group having 1 to 6 carbon atoms.

5. An etchant/primer adhesive monomer composition according to claim 1 wherein said compound of formula (I) is phenyliminodiacetic acid, salts thereof or esters thereof.

6. An etchant/primer adhesive monomer composition according to claim 1 wherein R^2 comprises a residue of crotonic acid, salts thereof or esters thereof.

7. An etchant/primer adhesive monomer composition according to claim 1 wherein said adhesive monomer system includes at least one monomer with an ethylenically unsaturated group and having at least one surface-active functional group.

8. An etchant/primer adhesive monomer composition according to claim 7 wherein said at least one surface-active functional group is selected from the group consisting of carboxylic acid; phosphate, hydrogen phosphate, sulfonic acid, sulfonate, hydroxyl, aldehyde, isocyanate, secondary and tertiary amino; and quaternary ammonium groups; and groups which hydrolyze to form carboxylic acid groups.

9. An etchant/primer adhesive monomer composition according to claim 1 wherein said adhesive monomer system includes the reaction product of hydroxyethyl methacrylate and pyromellitic acid dianhydride.

10. An etchant/primer adhesive monomer composition according to claim 1 wherein said adhesive monomer system includes a free radical initiator.

11. An etchant/primer adhesive monomer composition according to claim 1 wherein said adhesive monomer system includes a redox metal compound.

12. An etchant/primer/adhesive monomer composition according to claim 2 wherein said solvent includes an alcohol.

13. An etchant/primer/adhesive monomer composition according to claim 2 wherein said solvent includes ethanol.

14. An etchant/primer/adhesive monomer composition according to claim 2 wherein said solvent includes dimethylsulfoxide.

15. A kit for forming a polymeric material at and a strong integrated bond with a dental or other substrate surface comprising:

(a) a first container containing an etchant/primer composition comprising:

a compound having the formula



wherein $\text{R}=\text{R}^1$ or R^2 ;

R^1 =an aromatic group;