

type and amounts used in each sample are identified in Table IV. Results of this testing is given in Tables V and VI, and in FIGS. 2 and 3.

**TABLE IV – BORDEN Resin Layers on 12/20 Mesh Ground Walnut Shell Material**

Sample Identifier	Layer Type and Amount (% by Weight of Total Weight of Particle) *
A	Inner layer of 2% by weight BORDEN "2AC" with Outer Layer of 4% by weight BORDEN "SIGMASET LV"
B	Layer of 6% by weight BORDEN "SIGMASET LV" resin (Coated particles having Borden identification code "66040")
C	Layer of 6% by weight BORDEN "SIGMASET LV" resin (Coated particles having Borden identification code "66535")
D	BORDEN Two Coat Resin – Inner layer of 2% by weight separate hardener material and outer layer of 3% by weight "SIGMASET LV" (Coated particles having Borden identification code "2PN3x")
E	Layer of 12% by weight BORDEN "SIGMASET LV"

\* -- In Table IV, BORDEN product identification codes 66040 and 66535 denote particles coated with "SIGMASET LV" resin having modified curing characteristics, *i.e.*, the first digit in the code represents the % by weight of resin applied as a percentage of total particle weight (*e.g.*, 6%), the second and third digits in the code represent weight percentage of the first resin component (*e.g.*, 60% and 65% respectively), and the fourth and fifth digits represent weight percentage of the second resin component (*e.g.*, 40% and 35% respectively).

TABLE V

Closure Stress, psi	Permeability, Darcies				
	Sample A	Sample B	Sample C	Sample D	Sample E
500	453	205	383	429	432
1000	303	146	200	153	319
2000	220	46	94	88	206
	105				76

TABLE VI

Closure Stress, psi	Cell Width, Inches				
	Sample A	Sample B	Sample C	Sample D	Sample E
500	0.43	0.43	0.41	0.41	0.43
1000	0.41	0.4	0.38	0.39	0.406
2000	0.36	0.345	0.3	0.35	0.35
2200	0.32				0.299

5        **FIG. 2** shows the permeability of the relatively lightweight particulate core materials having the various types of resin layers of this example at 500, 1000 and 2000 psi closure stresses and 150°F.

10        **FIG. 3** shows pack or conductivity cell width of the relatively lightweight particulate core materials having the various types of resin layers of this example at 500, 1000 and 2000 psi closure stresses and 150°F. Also shown is cell or pack width of the relatively lightweight particulate materials Samples A and E at 2200 psi closure stress and 200°F.

15        The results of Examples 1 and 2 illustrate just one way that relatively lightweight particulate core materials may be evaluated with various types and/or amounts of resins to fit

particular conditions, for example, anticipated wellbore or formation conditions. With benefit of this disclosure, those of skill in the art will understand that using this or other methods known in the art suitable for simulating anticipated downhole conditions, types of relatively lightweight material core materials and coatings (or combinations of two or more coatings) may be selected or tailored for use in a given desired application.

*Example 3: Conductivity Tests for Variously Treated Ground Walnut Shells*

Using a procedure similar to that of Example 1, conductivity tests were performed on three different samples of 12/20 mesh ground walnut shells at 150°F and at a concentration of 1 lb/ft<sup>2</sup>: Sample A (treated with inner layer of phenol formaldehyde resin and outer layer of urethane epoxy resin); Sample B (soaked for 4 hours at room temperature in FSA-1 siloxane-based compound); and Sample C (spray treated with FSA-1 in an amount of 26% by weight of the ground walnut hull material). The particles of Samples A and C were manufactured by FRITZ, while the particles of Sample B were manufactured in the laboratory. Results of this testing is shown in Table VII and FIG. 4.

TABLE VII

Permeability, Darcies			
Closure Stress, psi	Sample A	Sample B	Sample C
1000	91	240	250
2000	86	170	120
3000	30	100	80

FIG. 4 shows the permeability of the ground walnut hull materials of the three samples of this example at 500, 1000 and 2000 psi closure stresses and 150°F.

The results of this example illustrate how ground walnut hull materials modified with silane-based modifying agent may be used to form particulate packs having good permeability at increasing closure stresses.

*Example 4: Additional Conductivity Tests for Ground Walnut Shells*

- 5 Using a procedure similar to that of Example 1, conductivity tests were performed on two different samples of 12/20 mesh ground walnut shells at 150°F and at a concentration of 2 lb/ft<sup>2</sup>: Sample A (treated with urethane resin) and manufactured by FRITZ; and Sample B (soaked for 4 hours at room temperature in FSA-1 siloxane-based compound). Results of this testing is shown in Tables VIII - XI.

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**Table VIII – Sample A: Resin Coated Ground Walnut Hulls**

Temperature	150	Particulate Size	12/20	
Closure Pressure	3000 psi	Concentration	2	lbs/ft <sup>2</sup>
Fluid Pressure (psi)	200			

**TABLE IX – Sample A: Resin Coated Ground Walnut Hulls**

Test Data * Time (Hours)	Temp °C	Water Rate mls/ min	Visc- osity cp	DP psi	Width inches	Conduct- ivity md-ft	Permea- bility darcies	Closure Stress Psi
0	64.47	8.48	0.44	0.00635	0.59	15,637	318	1094
10	65.00	8.81	0.43	0.00909	0.55	11,253	246	1105
20	65.00	8.51	0.43	0.00969	0.55	10,190	222	1083
30	64.99	8.50	0.43	0.01567	0.39	6,302	194	2059
40	65.00	8.43	0.43	0.01669	0.39	5,861	180	2036
50	65.01	8.56	0.43	0.01926	0.39	5,162	159	2711
60	64.99	8.62	0.43	0.02654	0.37	3,772	124	3021
70	64.99	8.52	0.43	0.02861	0.37	3,458	114	2992

\* -- Values given represent an average of an hour's data at each given point.



**Table X – Sample B: Ground Walnut Hulls Treated with Modifying Agent**

Temperature	150°	Particulate Size	12/20
Closure Pressure	3000 psi	Concentration	2 lbs/ft <sup>2</sup>
Fluid Pressure (psi)	450		

**TABLE XI – Sample B: Ground Walnut Hulls Treated with Modifying Agent**

Test Data * Time (Hours)	Temp °C	Water Rate mls/ min	Visc- osity cp	DP psi	Width inches	Conduct- ivity md-ft	Permea- bility darcies	Closure Stress psi
0	64.46	8.21	0.44	0.00372	0.590	25,829	525	1412
10	65.00	8.20	0.43	0.00722	0.550	13,187	288	1405
20	65.00	8.21	0.43	0.00796	0.550	11,970	261	1413
30	64.99	8.20	0.43	0.02105	0.390	4,524	139	2379
40	65.00	8.20	0.43	0.02352	0.370	4,049	131	2379
50	65.01	9.18	0.43	0.03442	0.360	3,097	103	3039
60	64.98	8.20	0.43	0.04794	0.340	1,987	70	3074
70	65.00	8.20	0.43	0.05317	0.334	1,790	64	3043

\* -- Values given represent an average of an hour's data at each given point.

- 5        The results of this example also illustrate how ground walnut hull materials modified with silane-based modifying agent may be used to form particulate packs having good permeability at increasing closure stresses.

*Example 5: Stress Tests for Particulates of Various Naturally-Occurring Materials*

- 10        Using equipment similar to that employed for Example 1, stress tests were performed on particulate packs formed from four different particulate packs formed from four respective samples of 12/20 mesh naturally-occurring particulate material: Sample A (ground apricot pits); Sample B (ground walnut hulls having about 2% by weight moisture content); Sample C (ground walnut hulls having about 5% by weight moisture content); and Sample D (ground olive pits). The particles of each of Samples A through D were obtained from FRITZ, and were soaked for 4
- 15        hours at room temperature in FSA-1 siloxane-based compound. Each of the particulate samples was loaded into a test cell at a concentration of 1 lbs/ft<sup>2</sup> for testing at 150°F. During the test of

each particulate pack, increasing compressive stress was applied to the pack and the resulting width of the pack within the cell measured using a sensitive linear variable differential transducer.

Results of this testing is shown in FIG. 5 as a plot of pack width displacement (*i.e.* reduction in pack width) in millimeters versus increasing compressive force. As may be seen in FIG. 5, the modified ground apricot pits of Sample A exhibited the least pack width reduction with increasing force, translating into most retained permeability of the four samples at a given stress level. The modified ground olive pits of Sample D showed the most pack width reduction with increasing stress, translating into least retained permeability of the four samples at a given stress level. The modified ground walnut hulls of Samples B and C exhibited pack width reduction values in-between those of Samples A and D at most stress levels. In this regard, the modified ground walnut hulls of Sample B (having a moisture content of about 2%) exhibited less pack width reduction than the modified ground walnut hulls of Sample C (having a moisture content of about 5%) at a given stress level, showing that lower moisture levels may translate into increased strength or hardness for a given naturally occurring material. For example, in one embodiment of the disclosed compositions and methods, naturally-occurring particulate material (*e.g.*, ground walnut hull material) having a moisture content of from about 2% by weight of the material to about 5% by weight of the material may be employed.

While the invention may be adaptable to various modifications and alternative forms, specific embodiments have been shown by way of example and described herein. However, it should be understood that the invention is not intended to be limited to the particular forms disclosed. Rather, the invention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention as defined by the appended claims.

**WHAT IS CLAIMED IS:**

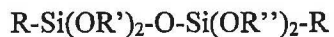
1. A method for treating a well penetrating a subterranean formation, comprising:  
  
introducing a particulate material into said well;  
  
wherein at least a portion of said particulate material comprises particles of a naturally-occurring material modified by penetration and reaction with at least one modifying agent, said modifying agent being effective to penetrate into and modify said naturally-occurring material within said particulate material by increasing the ability of said naturally-occurring material to resist deformation.
2. The method of claim 1, wherein said naturally-occurring material comprises plant-based or agricultural-based material, or a derivative thereof.
3. The method of claim 2, wherein individual particles of said modified naturally-occurring material comprise at least one of ground or crushed nut shells, ground or crushed seed shells, ground or crushed fruit pits, processed wood, or a mixture thereof.
4. The method of claim 2, wherein said modifying agent comprises at least one of a silane-based compound, siloxane-based compound, polyisocyanate-based compound, polyepoxy-based compound, or a combination thereof.
5. The method of claim 2, wherein said modifying agent comprises at least one of:

a silane-based compound having the formula:



wherein R is a branched or linear aliphatic carbon chain that is saturated or unsaturated, and that has from about 1 to about 10 carbon atoms; and wherein each R' is independently branched or linear carbon chain that is saturated or unsaturated, and that has from about 1 to about 4 carbon atoms; or

a siloxane-based compound having the formula:



wherein R is a branched or linear aliphatic carbon chain that is saturated or unsaturated, and that has from about 1 to about 10 carbon atoms; and wherein each R' and each R'' is independently a branched or linear carbon chain that may be saturated or unsaturated, and that has from about 1 to about 4 carbon atoms; or

a polyisocyanate-based compound having the formula:



wherein R is at least one of phenyl, derivatized phenyl, an aliphatic carbon chain having from about 2 to about 10 carbon atoms, or a combination thereof.

6. The method of claim 2, wherein individual particles of said modified naturally-occurring material are introduced into said well as substantially neutrally buoyant particles in a carrier fluid.

7. The method of claim 6, wherein said method further comprises introducing said individual particles of said modified naturally-occurring material and said carrier fluid into said subterranean formation at a pressure above a fracturing pressure of said subterranean formation.

8. The method of claim 6, wherein said method further comprises introducing said individual particles of said modified naturally-occurring material and said carrier fluid into said well as part of a sand control operation.

9. The method of claim 2, wherein at least a portion of individual particles of said particulate material each comprises a core component of said modified naturally-occurring material at least partially surrounded by at least one layer of a protective or hardening coating.

10. The method of claim 2, wherein at least a portion of individual particles of said particulate material comprises particles of a naturally-occurring material that have been exposed to an enhancing agent to facilitate interaction between said modifying agent and said naturally-occurring material.



11. The method of claim 2, wherein said wellbore has an angle with respect to the vertical of between about 30 degrees and about 90 degrees.

12. The method of claim 1, wherein said particles of a naturally-occurring material are not treated with resin.

13. A method of fracturing a subterranean formation, comprising:

introducing a particulate material suspended in a carrier fluid into said subterranean formation at a pressure above a fracturing pressure of said subterranean formation;

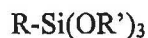
wherein at least a portion of the individual particles of said particulate material are substantially neutrally buoyant in said carrier fluid and comprise particles of a naturally-occurring material modified by penetration and reaction with at least one modifying agent in an amount effective to modify said naturally-occurring material within said particulate material by increasing the ability of said naturally-occurring material to resist deformation;

wherein at least a portion of individual particles of said modified naturally-occurring material comprise at least one of ground or crushed nut shells, ground or crushed seed shells, ground or crushed fruit pits, processed wood, or a mixture thereof; and

wherein said modifying agent comprises at least one of a silane-based compound, siloxane-based compound, polyisocyanate-based compound, or a combination thereof.

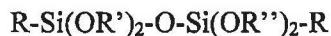
14. The method of claim 13, wherein said modifying agent comprises at least one of:

a silane-based compound having the formula:



wherein R is a branched or linear aliphatic carbon chain that is saturated or unsaturated, and that has from about 1 to about 10 carbon atoms; and wherein each R' is independently branched or linear carbon chain that is saturated or unsaturated, and that has from about 1 to about 4 carbon atoms; or

a siloxane-based compound having the formula:



wherein R is a branched or linear carbon aliphatic chain that is saturated or unsaturated, and that has from about 1 to about 10 carbon atoms; and wherein each R' and each R'' is independently a branched or linear carbon chain that may be saturated or unsaturated, and that has from about 1 to about 4 carbon atoms; or

a polyisocyanate-based compound having the formula:



wherein R is at least one of phenyl, derivatized phenyl, or an aliphatic carbon chain having from about 2 to about 10 carbon atoms; or

a combination thereof.

15. The method of claim 13, wherein said modifying agent comprises at least one of gamma-aminopropyltriethoxy silane, propyltriethoxysilane, or mixture thereof.

16. The method of claim 13, wherein at least a portion of individual particles of said modified naturally-occurring material comprise ground or crushed walnut shells, ground or crushed ivory nut shells, ground or crushed peach pits, ground or crushed apricot pits, ground or crushed olive pits, or a mixture thereof.

17. The method of claim 16, wherein a closure stress of a hydraulic fracture created during said introducing into said subterranean formation is greater than or equal to about 5000 psi.

18. The method of claim 17, wherein a temperature of said formation is from about 150°F to about 250°F.

19. The method of claim 18, wherein individual particles of said modified naturally-occurring particulate material have a greater resistance to deformation when exposed to said conditions of temperature and closure stress than do unmodified particles of the same naturally-occurring material.

20. The method of claim 13, wherein at least a portion of individual particles of said particulate material each comprises a core component of said modified naturally-occurring material at least partially surrounded by at least one layer of a protective or hardening coating.

21. The method of claim 13, wherein at least a portion of individual particles of said particulate material comprises particles of a naturally-occurring material that have been exposed to an enhancing agent to facilitate interaction between said modifying agent and said naturally-occurring material.

22. The method of claim 13, wherein said carrier fluid is an ungelled aqueous fluid, or an aqueous fluid characterized as having a polymer concentration of from greater than about 0 pounds of polymer per thousand gallons of base fluid to about 10 pounds of polymer per thousand gallons of base fluid, and as having a viscosity of from about 1 to about 10 centipoises.

23. The method of claim 22, wherein said particulate material has a specific gravity of from about 1 to about 1.5, and wherein said carrier fluid has a specific gravity of between about 1 and about 1.5.

24. The method of claim 23, wherein said wellbore has an angle with respect to the vertical of between about 30 degrees and about 90 degrees.

25. A sand control method for a wellbore penetrating a subterranean formation, comprising:
- introducing into said wellbore a slurry comprising particulate material and a carrier fluid;
- placing said particulate material adjacent said subterranean formation to form a fluid-permeable pack that is capable of reducing or substantially preventing the passage of formation particles from said subterranean formation into said wellbore while at the same time allowing passage of formation fluids from said subterranean formation into said wellbore;
- wherein at least a portion of the individual particles of said particulate material are substantially neutrally buoyant in said carrier fluid and comprise particles of a naturally-occurring material modified by penetration and reaction with at least one modifying agent in an amount effective to modify said naturally-occurring material within said particulate material by increasing the ability of said naturally-occurring material to resist deformation;
- wherein at least a portion of individual particles of said modified naturally-occurring material comprise at least one of ground or crushed nut shells, ground or crushed seed shells, ground or crushed fruit pits, processed wood, or a mixture thereof; and
- wherein said modifying agent comprises at least one of a silane-based compound, siloxane-based compound, polyisocyanate-based compound, or a combination thereof.
26. The method of claim 25, wherein said modifying agent comprises at least one of:

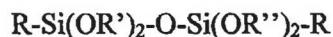


a silane-based compound having the formula:



wherein R is a branched or linear aliphatic carbon chain that is saturated or unsaturated, and that has from about 1 to about 10 carbon atoms; and wherein each R' is independently branched or linear carbon chain that is saturated or unsaturated, and that has from about 1 to about 4 carbon atoms; or

a siloxane-based compound having the formula:



wherein R is a branched or linear aliphatic carbon chain that is saturated or unsaturated, and that has from about 1 to about 10 carbon atoms; and wherein each R' and each R'' is independently a branched or linear carbon chain that may be saturated or unsaturated, and that has from about 1 to about 4 carbon atoms; or

a polyisocyanate-based compound having the formula:



wherein R is at least one of phenyl, derivatized phenyl, or an aliphatic carbon chain having from about 2 to about 10 carbon atoms; or

a combination thereof.

27. The method of claim 25, wherein said modifying agent comprises at least one of gamma-aminopropyltriethoxy silane, propyltriethoxysilane, or mixture thereof.

28. The method of claim 25, wherein at least a portion of individual particles of said modified naturally-occurring material comprise ground or crushed walnut shells, ground or crushed ivory nut shells, ground or crushed peach pits, ground or crushed apricot pits, ground or crushed olive pits, or a mixture thereof.

29. The method of claim 25, wherein at least a portion of individual particles of said particulate material each comprises a core component of said modified naturally-occurring material at least partially surrounded by at least one layer of a protective or hardening coating.

30. The method of claim 25, wherein at least a portion of individual particles of said particulate material comprises particles of a naturally-occurring material that have been exposed to an enhancing agent to facilitate interaction between said modifying agent and said naturally-occurring material.

31. The method of claim 25, wherein said carrier fluid is an ungelled aqueous fluid, or an aqueous fluid characterized as having a polymer concentration of from greater than about 0 pounds of polymer per thousand gallons of base fluid to about 10 pounds of polymer per thousand gallons of base fluid, and as having a viscosity of from about 1 to about 10 centipoises.

32. The method of claim 31, wherein said particulate material has a specific gravity of from about 1 to about 1.5, and wherein said carrier fluid has a specific gravity of between about 1 and about 1.5.

33. The method of claim 25, wherein said wellbore has an angle with respect to the vertical of between about 30 degrees and about 90 degrees.

34. The method of claim 25, further comprising injecting at least a portion of said slurry into said subterranean formation at a pressure exceeding a fracture pressure of said subterranean formation.

35. The method of claim 25, wherein a screen assembly having inner and outer surfaces is disposed within said wellbore, at least a portion of said outer surface of said screen assembly being disposed adjacent said subterranean formation; and wherein said method further comprises:

placing at least a portion of said particulate blend between said outer surface of said screen assembly and said subterranean formation to form said fluid-permeable pack.

36. A particulate composition, comprising particles of a naturally-occurring material modified by penetration and reaction with at least one modifying agent, said modifying agent being effective to penetrate into and modify said naturally-occurring material within said particulate material by increasing the ability of said naturally-occurring material to resist deformation.

37. The composition of claim 36, wherein said naturally-occurring material comprises plant-based or agricultural-based material, or a derivative thereof.

38. The composition of claim 37, wherein individual particles of said modified naturally-occurring material comprise at least one of ground or crushed nut shells, ground or crushed seed shells, ground or crushed fruit pits, processed wood, or a mixture thereof.

39. The composition of claim 37, wherein said modifying agent comprises at least one of a silane-based compound, siloxane-based compound, polyisocyanate-based compound, or a combination thereof.

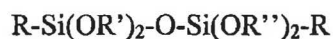
40. The composition of claim 37, wherein said modifying agent comprises at least one of:

a silane-based compound having the formula:



wherein R is a branched or linear aliphatic carbon chain that is saturated or unsaturated, and that has from about 1 to about 10 carbon atoms; and wherein each R' is independently branched or linear carbon chain that is saturated or unsaturated, and that has from about 1 to about 4 carbon atoms; or

a siloxane-based compound having the formula:



wherein R is a branched or linear carbon aliphatic chain that is saturated or unsaturated, and that has from about 1 to about 10 carbon atoms; and wherein each R' and each R'' is independently a branched or linear carbon chain that may be saturated or unsaturated, and that has from about 1 to about 4 carbon atoms; or

a polyisocyanate-based compound having the formula:



wherein R is at least one of phenyl, derivatized phenyl, or an aliphatic carbon chain having from about 2 to about 10 carbon atoms; or



a combination thereof.

41. The composition of claim 39, wherein at least a portion of individual particles of said modified naturally-occurring material comprise ground or crushed walnut shells, ground or crushed ivory nut shells, ground or crushed peach pits, ground or crushed apricot pits, ground or crushed olive pits, or a mixture thereof.

42. The composition of claim 41, wherein individual particles of said modified naturally-occurring particulate material have a greater resistance to deformation when exposed to a closure stress of greater than or equal to about 5000 psi than do unmodified particles of the same naturally-occurring material.

43. The composition of claim 41, wherein individual particles of said modified naturally-occurring particulate material have a greater resistance to deformation when exposed to a closure stress of greater than or equal to about 5000 psi and a temperature of from about 150°F to about 250°F than do unmodified particles of the same naturally-occurring material.

44. The composition of claim 39, wherein at least a portion of individual particles of said particulate material each further comprises a core component of said modified naturally-occurring material at least partially surrounded by at least one layer of a protective or hardening coating.

45. The composition of claim 39, wherein at least a portion of individual particles of said particulate material comprises particles of a naturally-occurring material that have been exposed to an enhancing agent to facilitate interaction between said modifying agent and said naturally-occurring material.

46. A method of modifying particles of a naturally-occurring material, comprising:

penetrating and reacting particles of a naturally-occurring material with an effective amount of at least one modifying agent to modify said naturally-occurring material within said particulate material by increasing the ability of said naturally-occurring material to resist deformation.

47. The method of claim 46, wherein said naturally-occurring material comprises plant-based or agricultural-based material, or a derivative thereof.

48. The method of claim 47, wherein individual particles of said modified naturally-occurring material comprise at least one of ground or crushed nut shells, ground or crushed seed shells, ground or crushed fruit pits, processed wood, or a mixture thereof.

49. The method of claim 48, wherein said modifying agent comprises at least one of a silane-based compound, siloxane-based compound, polyisocyanate-based compound, or a combination thereof.

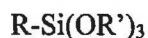
50. The method of claim 49, wherein said method further comprises exposing said particles of said naturally-occurring material to an effective amount of an enhancing agent to facilitate interaction between said modifying agent and said naturally-occurring material.

51. The method of claim 49, wherein said method further comprises applying at least one layer of a protective or hardening coating to said particles of modified naturally-occurring material.

52. A particulate material, comprising particles of modified naturally-occurring material made by the method of claim 46.

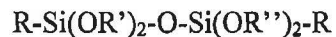
53. The method of claim 47, wherein said modifying agent comprises at least one of:

a silane-based compound having the formula:



wherein R is a branched or linear aliphatic carbon chain that is saturated or unsaturated, and that has from about 1 to about 10 carbon atoms; and wherein each R' is independently branched or linear carbon chain that is saturated or unsaturated, and that has from about 1 to about 4 carbon atoms; or

a siloxane-based compound having the formula:



wherein R is a branched or linear carbon aliphatic chain that is saturated or unsaturated, and that has from about 1 to about 10 carbon atoms; and wherein each R' and each R'' is independently a branched or linear carbon chain that may be saturated or unsaturated, and that has from about 1 to about 4 carbon atoms; or

a polyisocyanate-based compound having the formula:



wherein R is at least one of phenyl, derivatized phenyl, or an aliphatic carbon chain having from about 2 to about 10 carbon atoms; or

a combination thereof.

54. A method for treating a well penetrating a subterranean formation, comprising:

introducing a particulate material into said well;

wherein at least a portion of said particulate material comprises particles of a naturally-occurring material modified by exposure to at least one modifying agent, said modifying agent being effective to modify said naturally-occurring material by increasing the ability of said naturally-occurring material to resist deformation;

wherein said modifying agent comprises at least one of a siloxane-based compound, polyisocyanate-based compound, polyepoxy-based compound, or a combination thereof.

55. The method of claim 54, wherein said method further comprises introducing said individual particles of said modified naturally-occurring material into said subterranean formation at a pressure above a fracturing pressure of said subterranean formation.

56. The method of claim 54, wherein said method further comprises introducing said individual particles of said modified naturally-occurring material into said well as part of a sand control operation.

57. A method for treating a well penetrating a subterranean formation, comprising:

introducing a particulate material into said well;

wherein at least a portion of said particulate material comprises particles of a naturally-occurring material modified by exposure to at least one modifying agent, said modifying agent being effective to modify said naturally-occurring material by increasing the ability of said



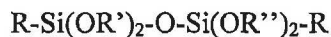
naturally-occurring material to resist deformation; wherein said naturally-occurring material comprises plant-based or agricultural-based material, or a derivative thereof; and wherein said modifying agent comprises at least one of:

a silane-based compound having the formula:



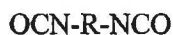
wherein R is a branched or linear aliphatic carbon chain that is saturated or unsaturated, and that has from about 1 to about 10 carbon atoms; and wherein each R' is independently branched or linear carbon chain that is saturated or unsaturated, and that has from about 1 to about 4 carbon atoms; or

a siloxane-based compound having the formula:



wherein R is a branched or linear aliphatic carbon chain that is saturated or unsaturated, and that has from about 1 to about 10 carbon atoms; and wherein each R' and each R'' is independently a branched or linear carbon chain that may be saturated or unsaturated, and that has from about 1 to about 4 carbon atoms; or

a polyisocyanate-based compound having the formula:



wherein R is at least one of phenyl, derivatized phenyl, an aliphatic carbon chain having from about 2 to about 10 carbon atoms, or a combination thereof.

58. A method of fracturing a subterranean formation, comprising:

introducing a particulate material suspended in a carrier fluid into said subterranean formation at a pressure above a fracturing pressure of said subterranean formation;

wherein at least a portion of the individual particles of said particulate material are substantially neutrally buoyant in said carrier fluid and comprise particles of a naturally-occurring material modified by exposure to at least one modifying agent in an amount effective to modify said naturally-occurring material;

wherein at least a portion of individual particles of said modified naturally-occurring material comprise at least one of ground or crushed nut shells, ground or crushed seed shells, ground or crushed fruit pits, processed wood, or a mixture thereof; and

wherein said modifying agent comprises at least one of:

a silane-based compound having the formula:



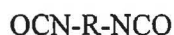
wherein R is a branched or linear aliphatic carbon chain that is saturated or unsaturated, and that has from about 1 to about 10 carbon atoms; and wherein each R' is independently branched or linear carbon chain that is saturated or unsaturated, and that has from about 1 to about 4 carbon atoms; or

a siloxane-based compound having the formula:



wherein R is a branched or linear carbon aliphatic chain that is saturated or unsaturated, and that has from about 1 to about 10 carbon atoms; and wherein each R' and each R'' is independently a branched or linear carbon chain that may be saturated or unsaturated, and that has from about 1 to about 4 carbon atoms; or

a polyisocyanate-based compound having the formula:



wherein R is at least one of phenyl, derivatized phenyl, or an aliphatic carbon chain having from about 2 to about 10 carbon atoms; or

a combination thereof.

59. A method of fracturing a subterranean formation, comprising:

introducing a particulate material suspended in a carrier fluid into said subterranean formation at a pressure above a fracturing pressure of said subterranean formation;

wherein at least a portion of the individual particles of said particulate material are substantially neutrally buoyant in said carrier fluid and comprise particles of a naturally-occurring material modified by exposure to at least one modifying agent in an amount effective to modify said naturally-occurring material;

wherein at least a portion of individual particles of said modified naturally-occurring material comprise at least one of ground or crushed nut shells, ground or crushed seed shells, ground or crushed fruit pits, processed wood, or a mixture thereof;

wherein said modifying agent comprises at least one of a silane-based compound, siloxane-based compound, polyisocyanate-based compound, or a combination thereof; and

wherein said carrier fluid is an ungelled aqueous fluid, or an aqueous fluid characterized as having a polymer concentration of from greater than about 0 pounds of polymer per thousand gallons of base fluid to about 10 pounds of polymer per thousand gallons of base fluid, and as having a viscosity of from about 1 to about 10 centipoises.

60. The method of claim 59, wherein said particulate material has a specific gravity of from about 1 to about 1.5, and wherein said carrier fluid has a specific gravity of between about 1 and about 1.5.

61. The method of claim 60, wherein said wellbore has an angle with respect to the vertical of between about 30 degrees and about 90 degrees.

62. A sand control method for a wellbore penetrating a subterranean formation, comprising:

introducing into said wellbore a slurry comprising particulate material and a carrier fluid;

placing said particulate material adjacent said subterranean formation to form a fluid-permeable pack that is capable of reducing or substantially preventing the passage of formation particles from said subterranean formation into said wellbore while at the same time allowing passage of formation fluids from said subterranean formation into said wellbore;

wherein at least a portion of the individual particles of said particulate material are substantially neutrally buoyant in said carrier fluid and comprise particles of a naturally-occurring material modified by exposure to at least one modifying agent in an amount effective to modify said naturally-occurring material;

wherein at least a portion of individual particles of said modified naturally-occurring material comprise at least one of ground or crushed nut shells, ground or crushed seed shells, ground or crushed fruit pits, processed wood, or a mixture thereof; and

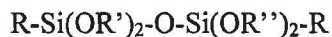
wherein said modifying agent comprises at least one of:

a silane-based compound having the formula:



wherein R is a branched or linear aliphatic carbon chain that is saturated or unsaturated, and that has from about 1 to about 10 carbon atoms; and wherein each R' is independently branched or linear carbon chain that is saturated or unsaturated, and that has from about 1 to about 4 carbon atoms; or

a siloxane-based compound having the formula:



wherein R is a branched or linear aliphatic carbon chain that is saturated or unsaturated, and that has from about 1 to about 10 carbon atoms; and wherein each R' and each R'' is



independently a branched or linear carbon chain that may be saturated or unsaturated, and that has from about 1 to about 4 carbon atoms; or

a polyisocyanate-based compound having the formula:



wherein R is at least one of phenyl, derivatized phenyl, or an aliphatic carbon chain having from about 2 to about 10 carbon atoms; or

a combination thereof.

63. A sand control method for a wellbore penetrating a subterranean formation, comprising:

introducing into said wellbore a slurry comprising particulate material and a carrier fluid;

placing said particulate material adjacent said subterranean formation to form a fluid-permeable pack that is capable of reducing or substantially preventing the passage of formation particles from said subterranean formation into said wellbore while at the same time allowing passage of formation fluids from said subterranean formation into said wellbore;

wherein at least a portion of the individual particles of said particulate material are substantially neutrally buoyant in said carrier fluid and comprise particles of a naturally-occurring material modified by exposure to at least one modifying

agent in an amount effective to modify said naturally-occurring material;

wherein at least a portion of individual particles of said modified naturally-occurring material comprise at least one of ground or crushed nut shells, ground or crushed seed shells, ground or crushed fruit pits, processed wood, or a mixture thereof;

wherein said modifying agent comprises at least one of a silane-based compound, siloxane-based compound, polyisocyanate-based compound, or a combination thereof; and

wherein said carrier fluid is an ungelled aqueous fluid, or an aqueous fluid characterized as having a polymer concentration of from greater than about 0 pounds of polymer per thousand gallons of base fluid to about 10 pounds of polymer per thousand gallons of base fluid, and as having a viscosity of from about 1 to about 10 centipoises.

64. The method of claim 63, wherein said particulate material has a specific gravity of from about 1 to about 1.5, and wherein said carrier fluid has a specific gravity of between about 1 and about 1.5.

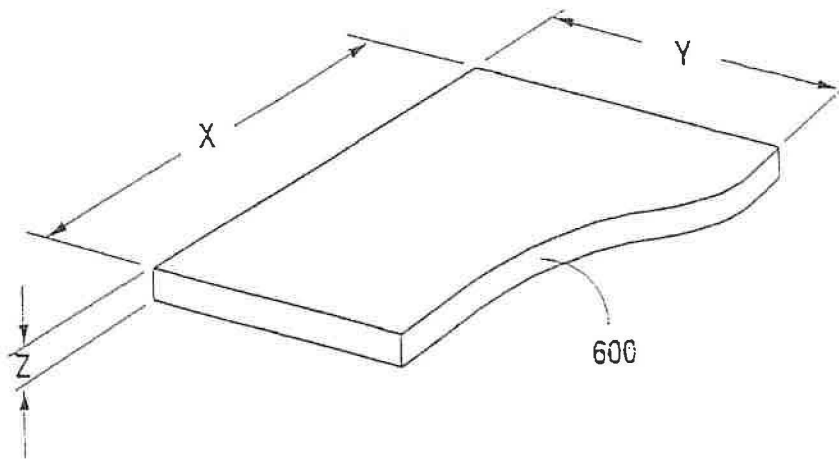


FIG. 1

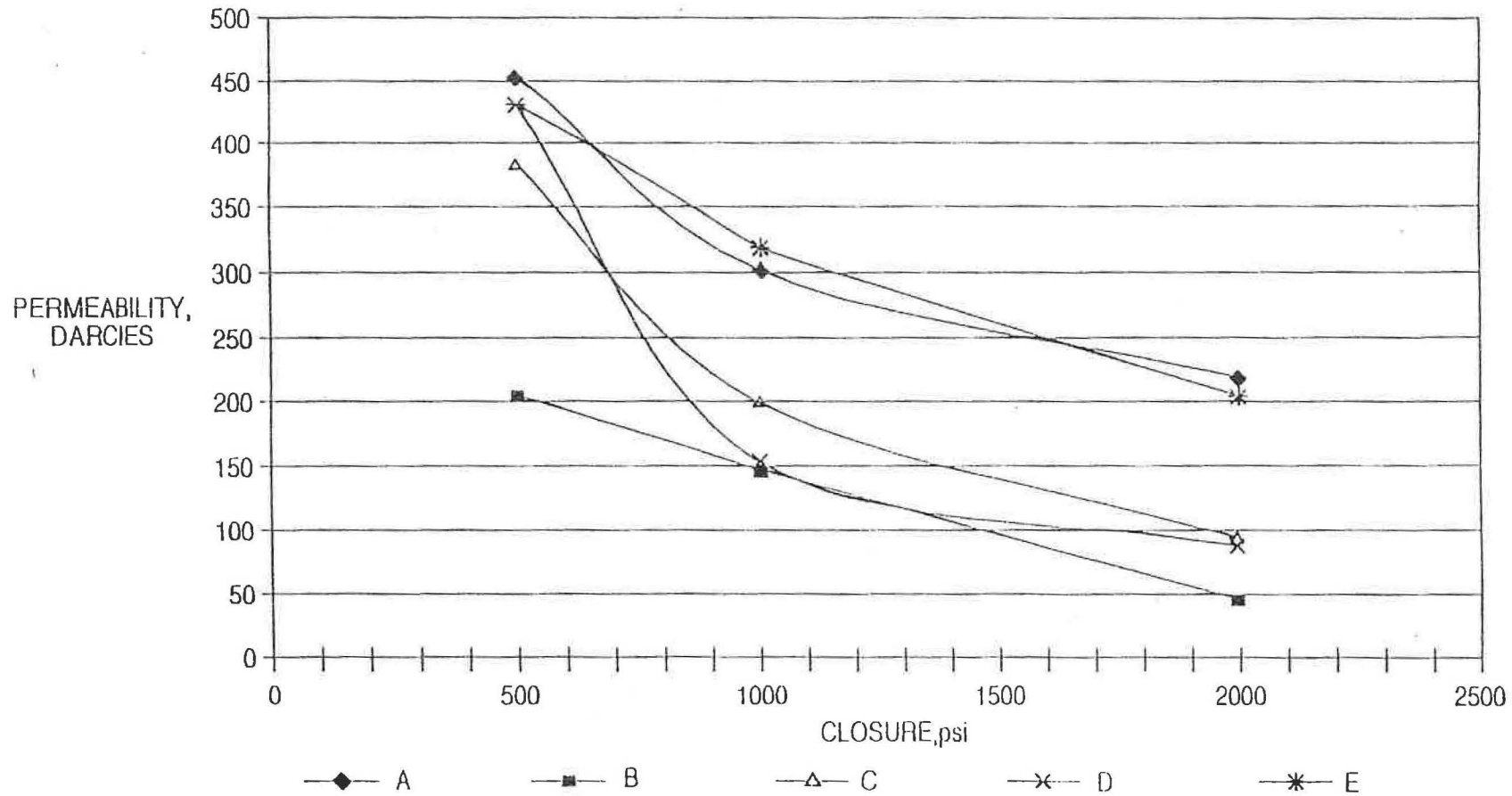


FIG. 2

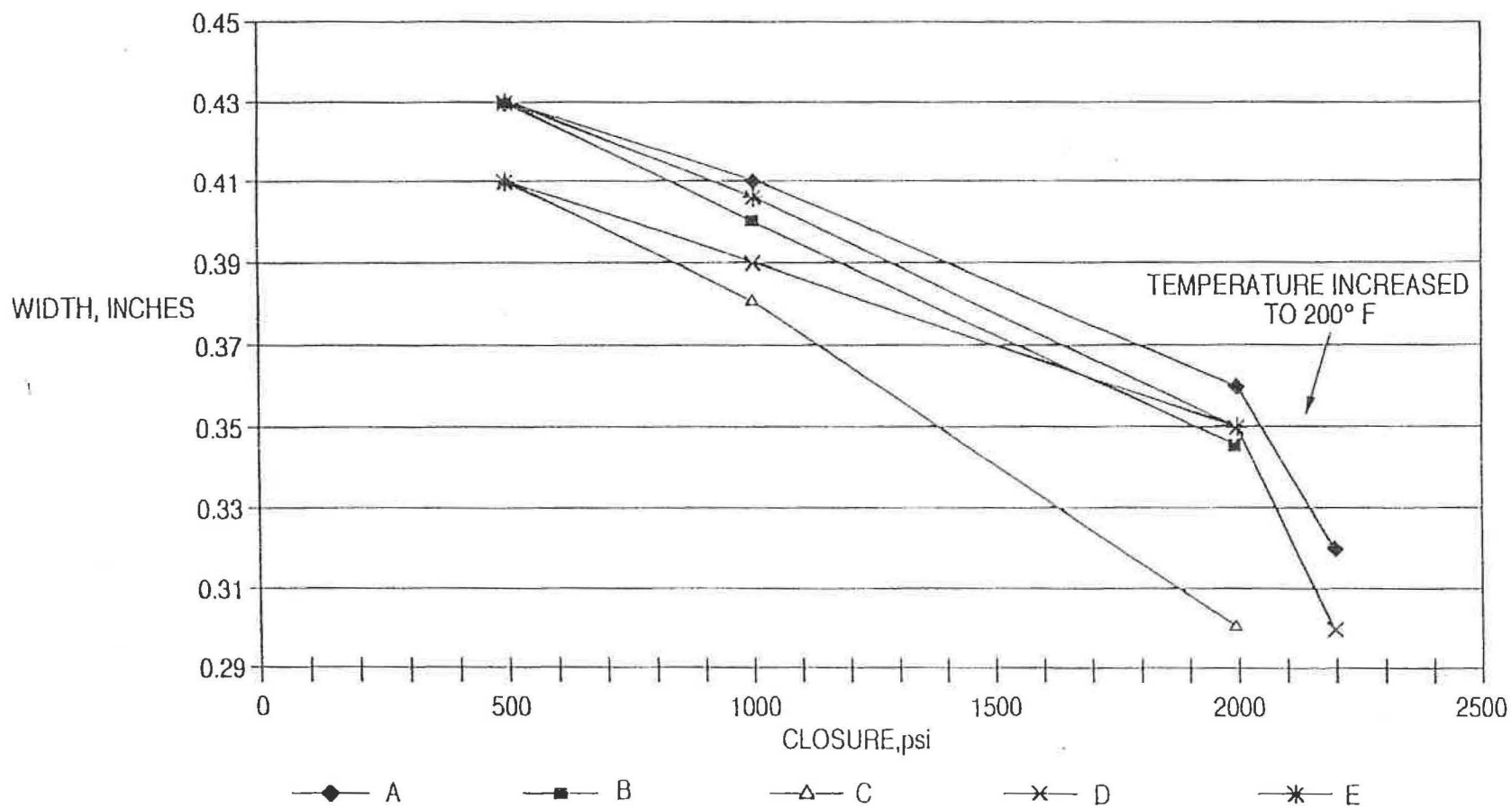


FIG. 3



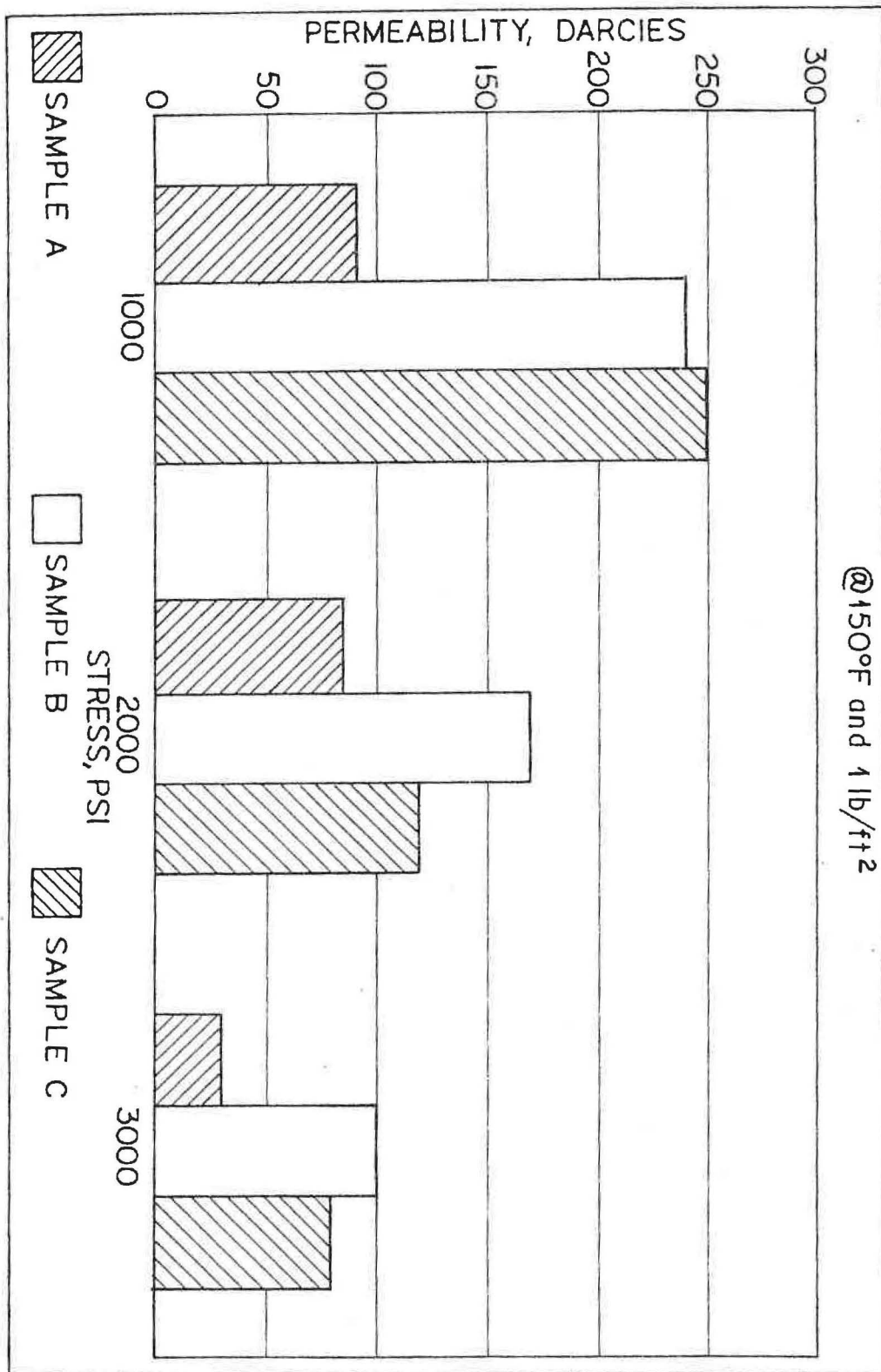


FIG. 4

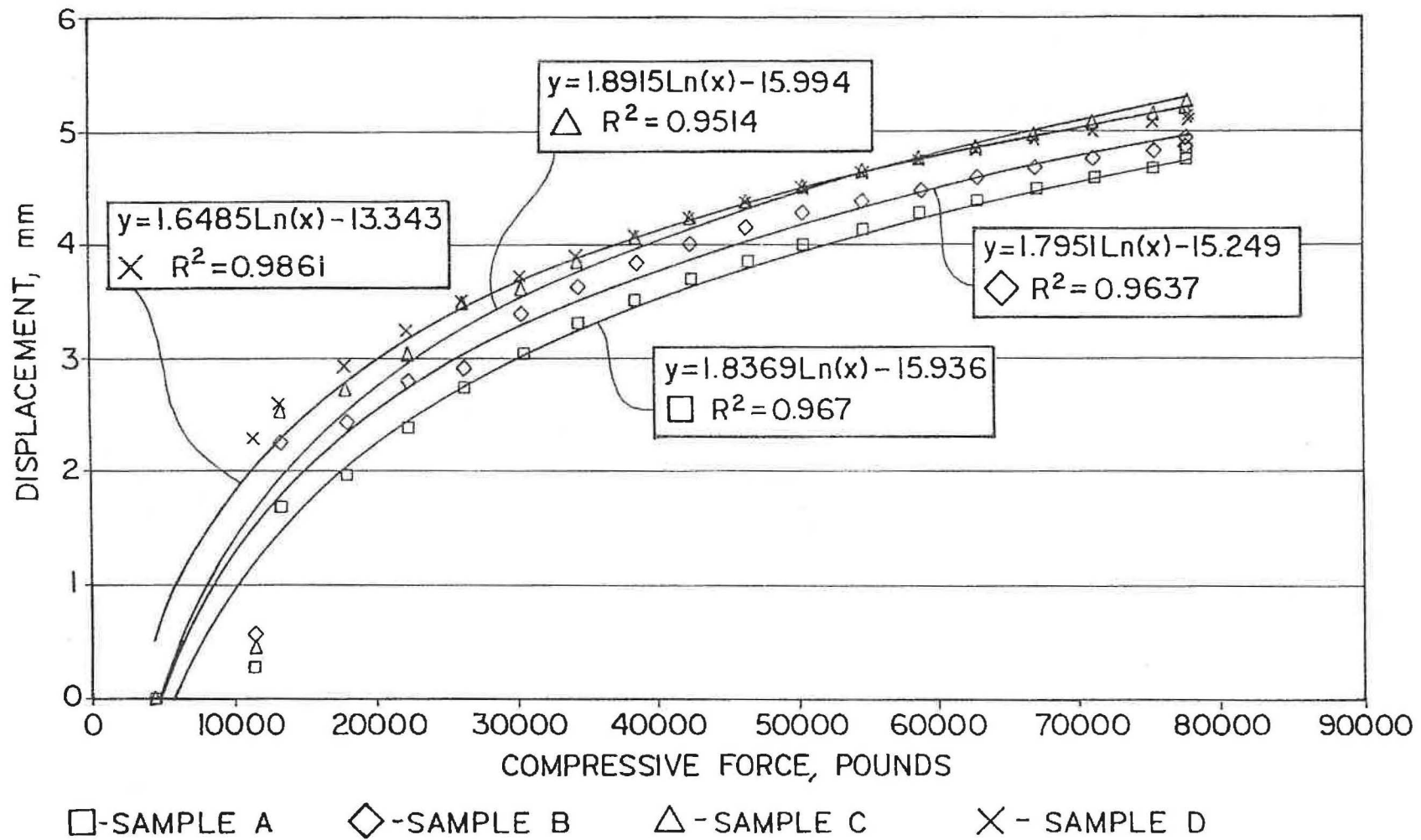


FIG. 5

