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IMPROVED MOISTURE RESISTANCE OF FIBER REINFORCED
PLASTICS(U) CASE-WESTERN RESERVESUNIV CLEVELAND OH
J L KOENIG 30 AUG 83 ARO-18628.6-MS DAR229-82-K-0100

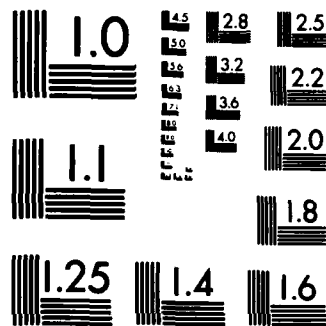
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A. Statement of Problem Studied.

We investigated the molecular basis of the hydrothermal instability of glass reinforced composites.

B. Summary of Most Important Results.

The effect of aminosilane coupling agents on the mechanical strength and hydrothermal stability of the interfacial bond strength of glass monofilament-epoxy resin composites has been investigated, using a monofilament pullout technique. A mechanical test system utilizing a glass monofilament composite has been developed in order to measure quantitatively the interfacial strength of the composite

Varying concentrations of different bifunctional aminosilanes are used for treating the glass monofilament. The treated monofilament, partially embedded in an epoxy matrix, is sheared in the direction of the monofilament by means of a pullout force, giving the shear debonding stress of the interface. To investigate the hydrothermal effect, the composite is immersed in 95°C water for varying periods of time, and the interfacial strength is determined. The effect of partial removal of the deposited aminosilane, prior to compositing, has also been studied. The treated monofilament is immersed in 95°C water for 4 hours, prior to composite preparation, and its interfacial strength is compared with the corresponding unmodified composite.

The use of a bifunctional silane coupling agent improves the mechanical strength and hydrothermal resistance of the interface. Partial removal of the deposited aminosilane, irrespective of its original thickness, enhances the interfacial strength of the composite to an optimum value. It is found that N-2-aminoethyl-3-aminopropyl trimethoxy silane (AAPS) imparts the most favorable results in comparison with 3-aminopropyl triethoxy silane (APS), and N-methylaminopropyl triethoxy silane (MAPS).

C. Publications.

H. Ishida, C.H. Chiang, J.L. Koenig, "The Structure of Aminofunctional Silane Coupling Agents: Part I: γ -aminopropyltriethoxysilane and its Analogues", Polymer **23**, Feb. 1982, pp. 251-257.

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C.H. Chiang, H. Emadipour, and J.L. Koenig, "Interfacial Strength Studies of Fiber-Reinforced Composites", Res Mechanica, **5** 1982, pp. 165-176.

J.L. Koenig, and C.H. Chiang, "In Situ Analysis of the Interface", in The Role of the Polymeric Matrix in the Processing and Structural Properties of Composite Materials, J.C. Seferis, and L. Nicolaïs Eds., Plenum Press, 1983.

continued...

C. Publications continued...

C.H. Chiang, N.I. Liu, and J.L. Koenig, "Magic-Angle Cross-Polarization Carbon-13 NMR Study of Aminosilane Coupling Agents on Silica Surfaces", J. of Coll. & Inter. Sci., 86(1) March 1982, pp. 26-34.

C.H. Chiang, and J.L. Koenig, "Fourier Transform Infrared Spectroscopic Study of the Adsorption of Multiple Amino-silane Coupling Agents on Glass Surfaces", J. Coll. & Inter. Sci., 83(2), 1981, pp. 361-370.

C.H. Chiang, and J.L. Koenig, "Chemical Reactions Occurring at the Interface Epoxy Matrix and Aminosilane Coupling Agents in Fiber-Reinforced Composites", Polym. Comp., 1, 1980 pp. 88-92.

D. Participating Scientific Personnel.

Jack L. Koenig

Chwan-Hwa Chiang, Ph.D., 1980

Hamid Emadipour, M.S., 1983

Yih-Tyan Liao, Ph.D. (to be received)

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