

THE DISCOVERY OF SILANE COUPLING AGENTS

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In the late 1940's, reinforced plastics had attracted considerable interest by the military because of their potential use in military aircraft. Polyester laminates, reinforced with glass fabric, were being examined as spacers for self-sealing gasoline tanks, and, more importantly, as non-shattering structural components. Laminates, based on unsaturated polyesters, approximated the flexural strength of structural steel and were stronger and lighter than structural aluminum alloys. The critical weakness of these laminates was the considerable loss (about 60%) in strength they exhibited on exposure to water vapor or liquid. Although some improvement was noted with the use of a new sizing agent, chromium methacrylate chloride, the loss in physical strength was still unacceptably high to allow the use of these laminates in aircraft.

To try to solve this problem, the Air Force in late 1949 or early 1950 granted a contract to the Bjorksten Research Laboratories of Madison, Wisconsin, for the development of a superior sizing agent. Success was achieved shortly thereafter. The breakthrough achieved by the Bjorksten Labs was reported at the Spring, 1951 meeting of the Reinforced Plastics Division of the SPI. They reported that vinyltrichlorosilane not only increased the initial laminate strength by 25%, the loss on humid aging was reduced to only 0-10%. These striking results were confirmed shortly thereafter by Dr. Robert Steinman of the Garan Chemical Company who reported essentially identical results using vinyltriethoxysilane. At around the same time, Owens Corning reported a similar product based on the sodium salt of vinyltrichlorosilane, called Finish 136. Thus, 3 different labs made virtually the same discovery within a very short period. All of their products are believed to have been based on vinyltrichlorosilane obtained from Linde (UCC) Silicones.

The rapid commercial acceptance of the vinylsilane coupling agents stirred renewed interest in George Wagner's Linde Research group. Wagner believed that the availability of silanes having new types of organic functionality would greatly broaden the utility of silane coupling agents. The resulting work of D.L. Bailey, Vic Jex and others led to a broad family of silane coupling agents which continue to dominate the market up to the present day.