

SHELL CHEMICAL CORPORATION

PLAINTIFF'S EXHIBIT

SH-1075

SHELL DEVELOPMENT CO

REC'D JUN 10 1953

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TO HANDLE:

ANS'D: BY:

MANAGER - MANUFACTURING OPERATIONS
DEPARTMENT - HEAD OFFICE

JUNE 8, 1953

SPECIFICATIONS FOR EPON
ADHESIVES VI AND VIII

HEAD OFFICE - RESINS AND PLASTICS
DEPARTMENT - MR. F. S. SHACKHAMER

We refer to your letter of May 26, 1953, and to previous conversation with Mr. T. S. Hook regarding the testing of the subject products.

With regard to the tensile shear tests, we suggest that the test results be considered as such and that they be not referred to as manufacturing specifications since we now have no real control over the tensile shear properties of the adhesive products. Rather, we should prefer to issue the data under the term "test results" where tensile shear test results are required by customers working under U.S.A.F. specification 14164. This would also conform with the recommendations given in your memorandum of May 27, 1951, to Western Division Manager of Chemical Products Department.

As we now see it, each batch of adhesive would be piloted by a preliminary, small sample batch prepared in the Denver Laboratory and tested at Union. If Union's test data were favorable, the large scale batch would be made at Denver, and a sample of this large batch would also be tested at Union.

According to present plans, Union would run tensile shear strength tests at -70°F, 77°F, and 180°F on both Adhesive VI and VIII. For Adhesive VIII additional tests may be required on early production to meet the requirements of U.S.A.F. specification 14164. We presume that you will be able to advise us as to the extent and nature of these tests in order that we may be able to make suitable arrangements with Union and/or Maryville.

Original Signed by E. L. Hutchins

For: A. W. Floor

REC:my

cc: Shell Dev., Maryville - Mr. R. S. Greenfelder
Union Laboratory - Dr. D. S. Hays
Julian Ryan, Denver - Mr. R. S. Hays

LAM 029136

ABS-018344

SHELL CHEMICAL CORPORATION

SHELL DEVELOPMENT CO.	
REC'D JUN 10 1953	
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TO HANDLE:	
U DWE	
ANS'D:	BY:

June 9, 1953

LOCKHEED AIRCRAFT CORP.
Materials & Process Engineering
Building 63, Plant A-1
Burbank, California

Attention: Mr. S. W. Coleman

Dear Steve:

In accordance with our recent telephone conversation, we are arranging for the shipment of a sample of EPOH Adhesive formulation 442-J from Emeryville for your evaluation. We are also sending a sample of EPOH Adhesive VIII, to which diisocyanide has been added as a curing agent. In our preliminary tests, this material appears to have considerable advantage with respect to pot life and properties over the normal Adhesive VIII cured with Curing Agent A, and may be of interest where long pot life is desired and a higher cure temperature can be tolerated.

Neither material is currently available commercially, although we are investigating production of the Adhesive VIII/diisocyanide combination, in case field evaluations indicate that it will be of interest to industry. The 442-J formulation, as you know, is still in the development stage and no plans have been made to produce it commercially.

Following is some information on the high-temperature adhesive designated as Formula 442-J. The particular lot being sent to you is Lot No. 607-12 and is referred to as "442-modified green". The formula is:

EPOH 1001	13 parts
Epoxyphen 5083 (Richfield Chemical Co.)	67 "
Aluminum Dust (General Chemical Co.) 1220,	
54% through 325 mesh	100 "
Diisocyanide (American Cyanamid Co.)	6 "
Copper-6-hydroxy quinoline	1 part

This material should be cured at 350°F for one-half hour. Only contact pressure is required. In tests with this formulation using 2482 Alclad aluminum, we have obtained tensile shear strengths at room temperature of about 2100 psi, at 300°F, about 1700 psi, and at -70°F, 2200-2300 psi. In these tests, the aluminum was cleaned by the methods specified in our data sheet on EPOH Adhesive VIII, with which you are familiar.

LAM 029137

ABS-018345

June 5, 1953

The storage life of this system is somewhat limited, although improvements have been made recently. When refrigerated to 30-40°F, the storage life is one month or slightly longer. At room temperature, we are now able to obtain 2-3 weeks' life without any loss in properties. Because of this, it is probably not necessary to refrigerate for shipment, but, in order to ensure optimum properties of the product we are sending you, we are packing it in dry ice, and it is suggested that you keep it refrigerated until you are ready to use it.

In our work with EPOX Adhesive VIII, there have been some limitations on its application due to the relatively short pot life and short open assembly time, which is only a few hours. We have, therefore, investigated the use of diisocyanide as a curing agent, instead of the normal Curing Agent A, adding 6 parts of diisocyanide per 100 parts of resin. This is blended into the adhesive as we manufacture it. Using this system, we have obtained the following tensile shear strengths, which are compared with the normal Adhesive VIII cured with Curing Agent A:

Test Temperature	Adhesive VIII/ Diisocyanide	Adhesive VIII/ Curing Agent A
-70°F	1300 psi	2600 psi
Room temperature	1200 "	2300 "
180°F	1200 "	1100 "
250°F	1150 "	1200 "
300°F	1200 "	400 "
325°F	510 "	

You will note from this that essentially all of the initial strength of the adhesive is retained to over 250°F, and the material is considerably better than the normal Adhesive VIII at 300°F.

This system has a shelf life of many months, if not infinite, and the open assembly time is unlimited. This will enable processors to lay up structures of any desired size in one application. Here again, only contact pressure is necessary to cure. The material should be cured for one hour at 250°F.

We trust you will find one or both of these adhesives useful in your development work and will be glad to work with you in adapting them to your application. If you should have any questions or problems regarding these materials, we trust you will not hesitate to contact us. We will look forward to hearing from you regarding the results of your tests.

Very truly yours,

ORIGINAL SIGNED BY J. L. MORRILL

John L. Morrill

Chemical Products Department

SCS2

cc: Los Angeles District Manager
Shell Development Company

(Mr. D. W. Klam)

LAM 029138

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