F.I. 149-2

INTERNAL CORRESPONDENCE

File Application Rubber

CHEMICALS AND PLASTICS • TARRYTOWN TECHNICAL CENTER TARRYTOWN, NEW YORK 10591

To (Name) Mr. J. L. Myers
Division
Location Niagara Falls

Date August 16, 1974
Originating Dept. Organic Elastomers
Answering letter date

Copy to
F. H. Ancker
S. E. Berger
R. E. Byrne
F. E. Critchfield
L. G. Krauskopf
R. W. Lindberg
J. E. McKeon
M. W. Ranney
W. C. Thurber

Subject Coupling Agents - CALIDRIA Asbestos

Ref.: Letters DDB to JLM dated 8/14/72 and 8/1/73

PLAINTIFF'S EXHIBIT
UC-379

The program to investigate the potential of utilizing phenolic interfacial coupling agents as a means of upgrading heat distortion resistance, compression set, permanent set and modulus when asbestos is used as a filler in rubber was augmented by the inclusion of a silane treated asbestos. The results to date in both respects are encouraging in that a positive coupling of the asbestos to the rubber backbone has been achieved. This letter will update you on our findings and serve to advise you that we recommend a continuance of these investigations. A Project Report will be issued shortly delineating the technology and tabulating the data with recommendations for further investigation.

Phenolic Interfacial Agents

The initial work involved the use of RG-600 (dimethylol tertiary-butyl phenol treated asbestos) as well as an "in-situ" treatment of HPO in both EPDM and NR using peroxide free radical and ionic sulfur and free radical sulfur mechanisms. The results showed a blocking effect due to the t-butyl tails with a drastic reduction in physical properties when compared to a control of straight HPO.

A review of the chemistry indicated the need of an active site to effect a coupling of the pre-reacted phenolic/asbestos specie with a rubber polymer backbone. Dr. M. Bertolucci provided us with a sample of HPO reacted with dimethylol isopropyl phenol and the results verify a coupling effect. The negative results of the RG-600 (DMTBP) were rectified via utilization of the active hydrogen available on the DM1PP submittal. It is apparent that the logic that led to this coupling should be extended to the use of a sulfur activated tail, most probably an ~SH or, if practical synthesis permits, a disulfide such as ~S - S~ . In any event, resolution of this technology should be programmed via environmental testing to determine the utility of phenolic interfacial agents on asbestos from a cost-performance viewpoint in rubber.

ACCEPTED
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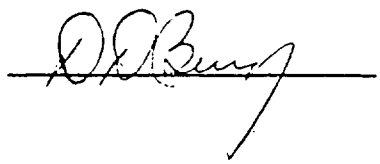
Mr. J. L. Myers August 16, 1974

Silane Coupling Agents

The letter of MWR to JHL (attached) indicates that the Acid Leached HPO (ALX) that was treated by S. E. Berger at Tarrytown with A-189 silane coupling agent gave positive filler-polymer coupling with a sulfur mechanism in EPDM and NR. The treatment of HPO with A-189 was tried a few years ago with no success. It was theorized that the resulting filler-coupling agent reaction of ~Mg-O-Si~ was the weak link in the filler-polymer bonding. Mr. Berger's treatment to remove the brucite surface of the HPO with subsequent treatment with A-189 has produced an ~Si-O-Si~ bond, the results of which are very encouraging. In strictly preliminary screening, we have seen the heretofore very high "set at break" (over 100%) reduced by factors of 4 to 5. This, along with over 50% increase in modulus, is proof that an effective coupling has occurred. We have asked Mr. Berger to prepare 10 lbs. of this material for further investigations. It is recommended that an acceleration study followed by environmental tests be set up to determine the cost-performance parameters of this specie.

In closing, it is apparent that an effective chemical bond is possible (with both of the above methods) between asbestos and a rubber backbone. As far as we know, this is the first time this has been done using these technologies. While considerable work is ahead to determine the feasibility of market penetration, the positive results to date encourage us to make the recommendation of extension of the concept of coupling agents for asbestos.

D. D. Berry/et
Enc.



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CHEMICALS AND PLASTICS • TARRYTOWN TECHNICAL CENTER. TARRYTOWN, NEW YORK 10591

To (Name) J. H. Lorenz
Division Chemicals and Plastics
Location New York - 32nd Floor

Date August 13, 1974
Originating Dept.
Answering letter date

Copy to S. E. Berger
C. A. Bergeson
D. D. Berry
L. G. Krauskopf
G. A. Skoler
K. J. Sollman
S. Sterman
W. C. Thurber

Subject Silane-treated Asbestos

As an extension of our recent work relating to the activation of asbestos for subsequent use as interfacial bonding agents, we have prepared a mercapto- and methacrylato-silane treated asbestos. Mr. Berger and I believe that these should respond in elastomers, epoxy, thermoset polyesters, etc., to give the typical reinforcing action noted with many other fillers and silanes.

A sample of A-189 treated asbestos (activated) was provided to Mr. D. Berry on May 8, 1974 with a request to run a few screening studies. The initial results look pretty encouraging and the physical properties clearly indicate that we are seeing effective coupling of the asbestos and the elastomers.

We believe that these observations, the first truly effective coupling of asbestos in rubber, can be translated to many similar polymer systems. This effect appears patentable and Mr. Berger is proceeding along these lines. As this is largely a non-programmed area, progress will be limited this year, but we do plan a continuing program and we will obtain sufficient data for a patent application by December 1, 1974.

In the meantime, we plan no outside disclosure of these very significant findings.

M. W. Ranney/ok