

The Goodyear Tire & Rubber Company

Akron, Ohio 44316 - 0001

January 27, 1987

Mr John Cross, V.P.
Mr Richard Znidarsic, T.D.
Chardon Rubber Co
373 Washington St
Chardon OH 44024

Gentlemen:

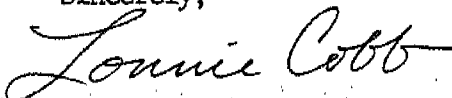
It was a pleasure talking with you both Wednesday afternoon. Under separate cover, samples of Chemigum P612-A and P615-D are being sent and attached to this letter are several pieces of literature you may find informative.

Your P612-A sample is partitioned with PVC to prevent blocking. The P615-D is partitioned with Calcium carbonate since this product is used in a broad selection of non-PVC applications. The inert CaCO_3 poses no problem in a PVC compound, however. Either of these products will provide processing and environmental advantages, however, for the maximum in physical properties, P83 is unequalled.

One of the largest growth areas for PVC is in applications which benefit from the addition of NBR to the PVC compound. A recent article in Modern Plastics describes the activities of several leading PVC compounders and their work with powder NBR. PVC/NBR alloys are recognized within Goodyear as an effective and inexpensive approach to the booming interest in Thermoplastic Elastomers. We can demonstrate head to head benefits over Santoprene, Geolast and Alcryn using several performance parameters.

Good luck with your evaluation and call if we can assist you.

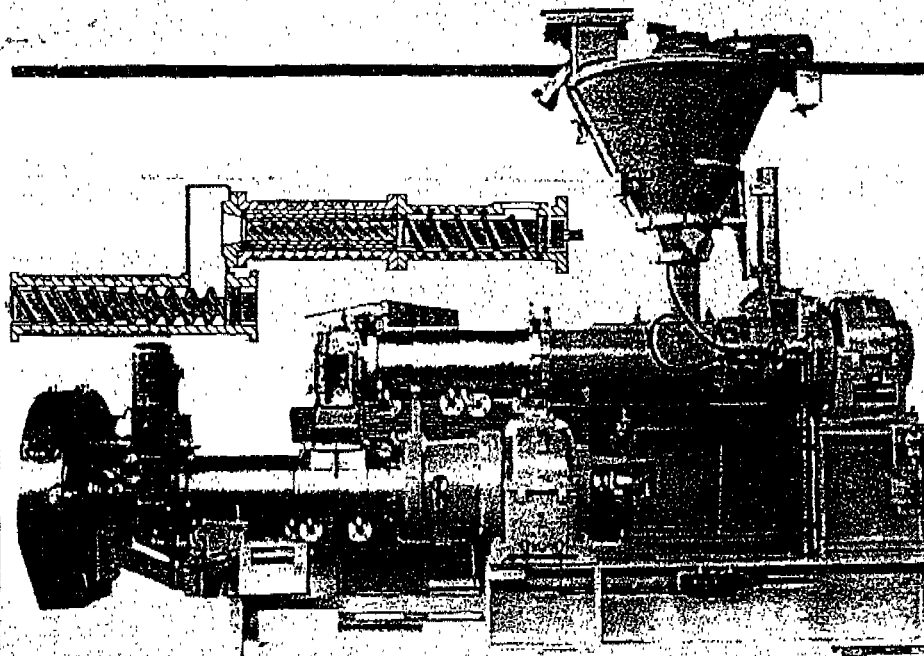
Sincerely,



L A Cobb
Marketing Specialist
Specialty Polymers
CHEMICAL DIVISION

LAC/cs

Attachments
cc: K M Kline



Planetary extruder is custom model, built by Battenfeld for Technical Plastic Extruders' new PVC compounding operations. The first stage is the planetary gear system, said to move material at up to 7000 lb./hr., generating high shear with low heat history.

VINYL COMPOUNDS

If it isn't available, odds are that it simply can't be made

By Susan Avery

TODAY'S vinyl compounders are making PVC capable of doing things it has never done before—even giving it properties claimed to approach those of more expensive engineering resins. They are steering their emphasis toward specialty markets. Their product-development efforts have a positive impact in areas of health concern.

Those are some of the thrusts of intensive development activity among compounders that is yielding effective new alternatives in such diverse areas as bottle compounds, conductive and antistatic formulations, medical grades, reinforced compounds, and elastomeric alloys. The effort has been inspired by stronger competition among compounders, between PVC and other materials, and between U.S. and overseas processors (see *Plasticscope*).

Buildup in food grades

Approval of PVC in food-contact uses and in liquor bottles has been imminent for so long that compounders of rigid vinyl have had plenty of time to develop new materials. Now that the proposed FDA regulations are almost in place (Mar MP, 18), healthy growth is expected in this area. At least eight of the more than 40 independent com-

pounders listed in the accompanying table now market bottle compounds (which are also available from resin producers Occidental, BFGoodrich, and Georgia Gulf).

Novatec, which offers variations of 25 different PVC bottle grades, says it has new injection-stretch blow molding compounds, low-odor/low-taste compounds for liquor bottles, and chemical-resistant formulations. The company is also working on an injection blow molding compound.

According to Keysor-Century sales director Kris Patel, injection blow molding compounds have always had a problem of low impact strength—2 or 3 Izod, compared with the 23-24 Izod of a typical extrusion blow molding compound. However, he says, his company now has an injection blow material with an Izod of 20. Its first commercial use is in a 1½ oz. hair color bottle.

The newest compounder of bottle and sheet grades is a producer of rigid PVC sheet that decided to purchase a Battenfeld planetary extruder for in-house compounding. Technical Plastic Extruders says it will apply about half of the new machine's 60-million-lb./yr. capacity to its own extrusion lines, and use the remaining 30 million lb. for custom compounding. John Pomeroy,

general manager of TPE's compound division, says the planetary extruder can process up to 7000 lb./hr., producing a compound with high impact strength, clarity, and heat stability. The first section of the two-stage machine has 12 planetary gears that masticate the material, rapidly pushing it forward with high shear but giving it little time for heat degradation. Thus better stabilization is attained, Pomeroy says.

"A lot of progress has been made recently both in impact modifiers and heat stabilizers," says Jim Howard, pres. of Hicol. The company has a new pelletized bottle compound claimed to offer improved clarity and stability.

Alternatives to phthalates

Vinyl compounders now are applying their expertise to a different regulatory issue from that which so long hampered food grades: the health effects of di(2-ethylhexyl) phthalate (DEHP) plasticizers. At issue is a Consumer Product Safety Commission recommendation that toy manufacturers voluntarily restrict use of DEHP in baby pacifiers because the additive is suspected to be a carcinogen (Jan MP, 28).

The CPSC request (it is not a ban) affects a very small application. However, some flexible vinyl compounders

anticipate that it could be the signal for a growing outcry against DEHP products in much wider markets. Therefore, many of them have introduced alternative compounds—usually formulations containing types of phthalate other than DEHP. One, however, has gone a step further by introducing a new compound system containing no phthalates.

The company is Alpha Chemical & Plastics, which specializes in compounds for uses specifying nontoxic ingredients. It has a new series of non-phthalate-plasticized flexibles for medical applications and children's products. The plasticizer used, called Superkleen, is based on a derivative of a tribasic monohydroxy acid that occurs naturally in foods. According to Alpha, processing and performance characteristics with Superkleen are comparable to those of DEHP-plasticized materials (p. 100). There's a tradeoff; price of Superkleen compounds is about double that of those that contain DEHP.

"We don't believe there is anything wrong with DEHP, but as long as there is any possibility of regulation, we'll offer an alternative," says Emery Szabo, Alpha's vp. technology. The company is building a dedicated line for Superkleen—in a separate facility to isolate it from phthalate operations.

Reinforced vinyl seeks a niche
Putting higher performance values into the mix is a major aim of merchant vinyl compounders. Such are the opportunities projected for reinforced vinyl, for example, that a number of independent compounders (and some basic resin producers) are investing heavily in developing filled materials that overcome most of the traditional processing difficulties.

Compounders are reinforcing vinyl with graphite, other minerals, and microspheres. Higher Molding has such products in flexible grades; company vp. Phil Shoemaker says reinforced vinyls already are replacing ABS in some applications. ComAlloy claims it is now possible to produce reinforced compounds with strength approaching that of reinforced polycarbonate.

Total reinforced PVC consumption in the U.S. last year was under a million pounds (chiefly for fluids-handling items), but that volume could be in for a sharp upturn, says Thermofil market manager Roy Bowers. He explains that the windowframe market is a natural for reinforced PVC. Unfilled vinyl windows consumed almost 75 million lb. of PVC last year, and even a small fraction of those applications switching to reinforced PVC could produce big numbers, Bowers says.

As with reinforcements (generally speaking), supplementing base resin with blowing agent produces products with good performance at reduced costs. It's a growing service from compounders. Global Products has developed expanded PVC in pellet form that can include nitrile rubber. Business manager Elliot Linsky says the compound, designed for footwear, produces an abrasion-resistant solid skin and good cell structure. "It is 10% more expensive by weight but costs 30% less on a volume basis because the material is expanded 50%," says Linsky.

Roscom has commercialized foamable PVC compound in pellet form for weight reduction in markets such as tubing and hose or automotive trim. It isn't an easy compounding challenge, and it requires sensitive process control, says Roscom pres. Michael Ross. Dom-Plast says it has a new foamable compound for shoe soles, Shulman makes one for automotive applications,

and Gary Chemical says it is "investing heavily" in R&D for low gravity and expandable PVC.

Action in blends and alloys

Upgraded toughness and other properties improvement through blending and alloying is getting increased emphasis by merchant compounders. It is opening new application possibilities.

For instance, Canadian General Tower blends PVC and nitrile rubber to achieve a compound with oil resistance, flexibility, and low-temperature properties retention. One of these PVC-nitrile compounds is used in a fire-extinguisher hose meeting a U.S. service requirement for operation at -65°C. Flex Products has a new PVC-nitrile for the shoe market that can be custom-formulated to vary texture and hardness (to as low as 45 durometer). Mach-1, a specialist in elastomeric compounds, has a blend of nitrile and PVC for printing-blanket rolls. And Roscom is developing PVC-

Independent merchant-market vinyl compounders

Company	Compound type	Specialties, latest developments
Abbey Plastics, Hudson, MA (421)*	FX, RG*	Carbon-filled conductive and new clear antistatic compounds.
Alpha Chemical & Plastics, subs. Dexter Corp. Newark, NJ (422)	FX, RG	New non-phthalate FX for medical, children's products. Expanding R&D facilities. Also working on elastomeric PVC.
BP Performance Polymers, Mansfield, MA (423)	FX	Wire-and-cable (W&C), auto specialty compounds.
Canada Colors, Colborne, Ont. (424)	FX	W&C major market. Injection molding (IM) compounds, also makes color concentrates.
Canadian General Tower, Oakville, Ont. (425)	FX, RG	PVC-nitrile alloys for hose, FX for automotive, RG (including ABS-PVC alloy) for construction, studying bottle market.
Carlew, subs. Synergistics, St. Remi, Que. (426)	FX, RG	Primarily W&C. New compounding line to make high-density powder for rigid profiles. May build new plasticizer plant.
Cary, subs. Synergistics, Farmingdale, NJ (427)	FX, RG	Primarily W&C, but recent entry into bottle market. Expanding RG capacity.
Color Custom Compounding, Warren, MI (428)	FX	Auto market, custom colors. Working on emulsion material in pellet form for extrusion.
Colorite, Ridgely, NJ (429)	FX, RG	Radiation-resistant medical and food grades, new light stable clear RG, low-extractable FX
Comalloy, Nashville, TN (430)	RG	Application-engineered compounds, alloys. New ABS-PVC alloy for appliances, business machines, glass fiber-reinforced PVC.

nitrile blends for under-the-hood use.

PVC-urethane alloys are available from Franklin Plastics, which makes them for footwear compounds, and cites their high abrasion resistance. Sylvania produces a number of flexible alloys, including urethane-PVC, that it says combines abrasion resistance with good low-temperature performance. Flex Products has an R&D program that includes alloying with urethane for gasoline resistance.

Franklin also has alloys of ethylene-vinyl acetate and PVC, with different performance at different load levels. For instance, says vp. Marvin Naftal, a flexible compound containing 5-25% EVA offers good traction for footwear; an alloy containing 30-70% EVA needs no plasticizer and can be used in non-contaminating wire-and-cable jackets. One of Pantasote's latest formulations is a fiber-optic grade of its Pantalast EVA-PVC copolymer series.

Roscom is developing alloys for exterior profiles to increase resistance to heat distortion, especially for heat-absorbing dark colors. ComAlloy has an ABS-PVC alloy (832-1000) designed to replace flame-retardant ABS in business machines and appliance applications where heat resistance is not critical but additional toughness (Izod of 12 ft./lb.) is necessary.

And Color Custom Compounding is working on an extrudable, pelletized emulsion compound said to give profiles a satiny surface. The material is half flexible PVC and half plastisol; it's suggested for auto body side moldings.

Expanding in specialties

Vinyl compounding has always been more or less a custom business. But with increased performance demands coming from specific markets and with increased competition to meet those demands, it is becoming even more customized. The evidence is implicit in a rollout of new value-added products that encompass compounds, dedicated wire-and-cable grades, automotive specialties...whatever the market requires. Some current examples:

Abbey Plastics, a specialist in conductive PVC, has developed a line of antistatic clears, priced from \$1.40 to \$2.25. Potential applications include semi-rigid extruded sheet for chair mats at computer terminals, clear windows in antistat computer-chip carriers, and flexible soles for work shoes used in clean-room environments.

Mitech is working with G.S. Plastics to develop a more-efficient conductive flexible PVC that is under test in a packaging application. Higher Molding is developing static-dissipative and conductive compounds. And Hicol has a

Company	Compound Type	Specialties, latest developments
Dom-Plast, Trenton, Ont. (431)	FX	Clear, GP, medical, food grades, shoe soles (including foamable); Captive W&C.
Flex Products, Baltic, OH (432)	FX, RG	New: National Sanitation Foundation IM RG; PVC-nitrile for shoes. Working on alloys and RG for extrusion. Expanding labs.
Franklin Plastics, div. Spantech, Kearny, NJ (433)	FX	W&C footwear, auto, custom compounds; Color matching. PVC-EVA alloys; Dull and clear FR W&C compounds.
G.S. Plastics, Cleveland, OH (434)	FX	Major market IM, working on FX conductive compounds with Mitech.
Gary Chemical, Leominster, MA (435)	FX, RG	RG grades are new. Low-smoke W&C, new footwear blends, nontoxic FX for medical. R&D: expandable PVC.
Global Products, Leominster, MA (436)	FX	Major markets W&C, footwear. New expandable PVC for soles. Plans RG entry in 1987.
Hicol, subs. Howard Industries, Columbus, OH (437)	RG	Clear for bottles and sheet, toll and proprietary. New EMI shielding pellets.
Higher Molding, Jamestown, NC (438)	FX, RG	All custom work. Developing reinforced, static-dissipative, conductive, and medical grades.
Hoffman Plastic, Paramount, CA (439)	FX, RG	W&C, FDA FX grades, pellets for profiles and molding, powder for pipe. Planning to expand.
Intamix, Conroe, TX (440)	RG	Powdered compounds for pipe, profiles. Adding sampling line and new 130-million-lb. line.
Keysor-Century, Saugus, CA (441)	FX, RG	Record and bottle compounds, New high-impact injection blow molding formulation. Custom FX.
Lenahan Assoc., Pitman, NJ (442)	FX, RG	Record compounds, custom formulating.
Lynn Plastics, Lynn, MA (443)	FX, RG	Automotive, W&C, shoes. RG new. Expanding capacity, adding new automated process controls.
Mach-1 Compounding, div. Burton Rubber, Burton, OH (444)	FX, RG	Custom compounding. Elastomeric alloys, also low-smoke and FR compounds.
Mitech, Willoughby, OH (445)	RG	Specializes in conductive and static-dissipative compounds.
Moore Chemical, City of Industry, CA (446)	FX	GP extrusion, custom IM, W&C. Expanding capacity. Some captive use for garden hose.
North American, Aberdeen, MS (447)	FX	W&C, automotive, film, footwear, GP molding compounds. New plant fully automated.

Company	Compound Type	Specialties, latest developments
Novatec, subs. PVC Container, Eatontown, NJ (448)	RG	New stretch blow molding, low-odor and taste, and chemical-resistant bottle compounds. Also new dedicated line for opaques.
Pantasote, Passaic, NJ (449)	FX, RG	Compound series based on EVA/PVC copolymer.
PVC Compounders, div. Lyall Electric, Kendallville, IN (450)	FX	W&C, electrical, GP compounds. New compound for thin-wall automotive wire. Some captive use.
Ristance Compounds, div. Echlin Co., Mishawaka, IN (451)	FX, RG	Primarily W&C, some captive use. Cites growing demand for low-smoke and FR compounds.
Rochevert, subs. Synergistics, Valleyfield, Que. (452)	FX, RG	Expanding bottle capacity. New calcium-zinc-stabilized RG, clear FX for medical, low-VCM, ultra-soft, and expandable PVCs.
Roscom, Trenton, NJ (453)	FX, RG	New pelletized expandable FX. R&D focus on exterior profiles. PVC-nitrile blends. Doubled capacity in past year.
Rutland Plastics, Pineville, NC (454)	FX, RG	New: clear static-dissipating semirigid, low-smoke FR for W&C.
A. Schulman, Akron, OH (455)	FX	Automotive; specialty markets. GP, non-migrating, expandable PVC, and other custom compounds.
Sylvania Chem., Denver, PA (456)	RG, FX	Proprietary compounds include alloys with nitrile, ABS, CPE, and PUR. To double FX capacity.
Technical Plastic Extruders, Newark, NJ (457)	FX, RG	Will produce primarily clears with new planetary extruder. Plant built to FDA specifications.
Teknor Apex, Pawtucket, RI (458)	FX, RG	Proprietary compounds, custom color expertise.
Thermofil, Brighton, MI (459)	RG	Glass-reinforced and other filled compounds. New exterior profile applications.
U.S. Polymers, subs. Harwal, Commerce, CA (460)	RG, FX	"Crystal-clear" and custom formulations. Low-taste and odor bottle compounds.
Vichem, Grand Rapids, MI (461)	FX, RG	Automotive color mastering, non-migrating compounds. Possible entry into clears.
Vinyl Industrial Products, div. Leon Plastics, Grand Rapids, MI (462)	FX, RG	Custom compounding, some captive use, primarily for automotive. Tailored surface properties.
Youngstown Vinyl Compounds, div. Kessler Products, Youngstown, OH (463)	FX	Mostly captive, but also custom compounding, all markets except food and medical.

a. Reader Service number. Circle on Reader Service card for more information.
b. FX = flexible, RG = rigid

new compound called EMIBlend for EMI shielding.

In wire-and-cable, a key R&D target is minimizing smoke generation. New formulations include a dull-surface extrudable compound from Franklin, said to be cost-competitive with thermoplastic elastomers; a flame-retardant clear material from Franklin; high-flow compounds from Flex Products; thin-wall automotive wiring compounds from PVC Compounders; and high-temperature materials from Cary Chemicals.

Novatec's primary specialty is bottle compound, but the company has begun marketing compounds for rigid film and sheet, outdoor furniture, and window profiles. It has doubled capacity to 50 million lb. since 1983 and plans to double again by 1990.

Most of Shulman's vinyl compounds go into the automotive market. Larry Kushkin, vp. automotive sales, says the newest applications are in steering wheels and in glass- and metal-encapsulation. A soft-durometer Shulman compound for steering wheels is being used by Canadian molder Centeco for 1987 Chrysler luxury cars.

Vichem plant manager Terry Nicholas, says the company has developed non-migrating compounds and specialty alloys for automotive applications, but now wants to expand into other markets as "a well-rounded custom compounder."

Custom is the key word. Dom-Plast's Gordon Bennett says compound buyers need the competitive edge that a special material can provide both at home and abroad: "They know where resin and additive pricing is heading, they use more sophisticated processing techniques, and they are more demanding in terms of specific property requirements. North American product manufacturers in general have come to realize they have to compete in an international marketplace."

"Compounding is more competitive than ever," says Roscom's Ross. "So our focus has to be on giving the best value for the dollar." He says Roscom accomplishes this by having very efficient equipment (nothing over four years old), producing a compound that processes easily (using a proprietary stabilizer and lubrication system), and ensuring strict quality control.

Customized services are available from all parts of the merchant-compounding spectrum. Intamix, whose basic business is tolling vinyls primarily for pipe and profile, has inaugurated a custom service of its own. Since the beginning of the year it has concentrated its efforts on helping processors to convert single-screw extruders to run powder blends. ■

GOODYEAR



**A new move
for CHEMIGUM P83**

(Gasket made by Richard Fritz KG)

CHARDO 01869

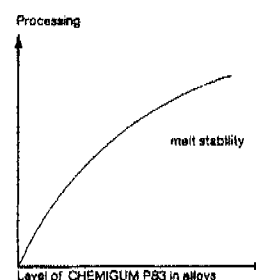
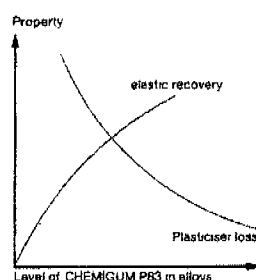
GOODYEAR

CHEMIGUM P83/PVC alloys provide the required elastomeric properties for long term functioning of auto gaskets. These include rubber like matt finish, low compression set, flexibility and dimensional stability over the entire range of service temperature.

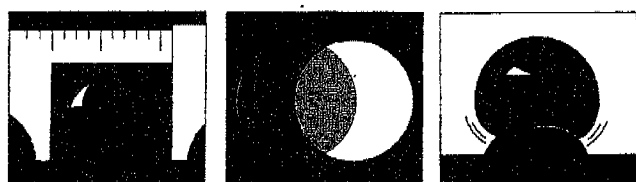
CHEMIGUM P83 in the alloys inhibits plasticiser migration and thus staining of painted surfaces. By minimising plasticiser volatilisation, it ensures that gaskets remain flexible in service. Properly formulated alloys exhibit good weatherability.

Typical properties

S.G.	1.20
Modulus (100 %), MPa	4.2
Tensile Strength, MPa	13.7
Tear Resistance, N/mm	39
Low temperature Flexibility, °C (Clash & Berg)	-43



The level of CHEMIGUM P83 in the alloys varies from 30 to 50 parts per 100 parts of PVC, depending on the gasket type.



Processing

In injected gaskets for fixed windows of cars, which is the case in the picture shown overleaf, thermoplastic CHEMIGUM P83/PVC alloys exhibit excellent melt-flow which enables fast mould fill-in of even the most intricate shape and long flow lengths.

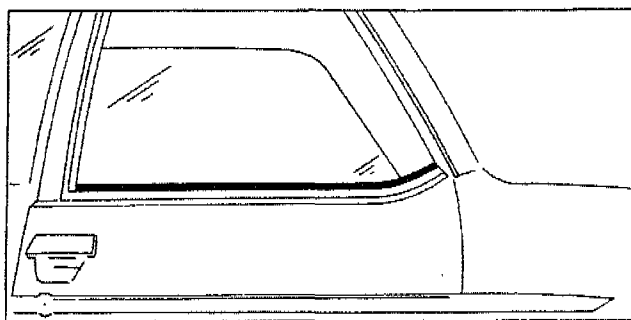
In extruded auto profiles, the high melt-stability of the alloys ensures that complex shapes are consistently produced at high output rates, as in the case of carrier strips. In coextrusions of CHEMIGUM P83/PVC weatherstrips onto rigid plastic or primer treated metallic supports, complete melt fusion provides a strong bond. Microcellular seals exhibit smooth surface finish of a uniform skin thickness and high resilience due to homogeneity of the cell network.

NOTE: While the information herein is believed to be reliable and correct, nothing herein is intended and should not be construed, as a representation or warranty, express or implied, as to results obtained or to be obtained by others who may make use of this information or with respect to the absence, existence or validity of patent rights, if any, of others involving any composition or process herein referred to - or an inducement or recommendation for the violation of any such patent rights, and responsibility and liability is disclaimed.

Cost saving designs

The thermoplastic CHEMIGUM P83/PVC alloys are a new and accepted concept in auto gasketing. They have made it possible to combine elastomer like properties with designs that save costs. For instance, static quarterlight gaskets are being directly bonded onto glass during the injection cycle, saving on both production and assembly costs.

Another development in cost saving design is coextrusion of microcellular tubular seals onto carrier strips which contrasts with the glueing of vulcanised rubber seals for auto boots and doors. The same is true of coextruded weatherstrips (lip seals) for windows.



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**P83
CHEMIGUM®**

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