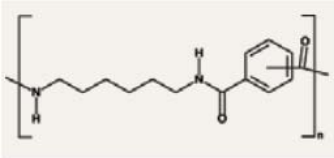
VESTAMID® HT*plus*

in plastic-rubber composites

Evonik manufactures a line of compounds specially modified for the production of adhesion promoter-free plastic-rubber composites. The newest development in this line is

- Polyphthalamide compounds VESTAMID® HT*plus*



Hard-soft composites

Wherever rubber components must be fastened or fixed, composites consisting of a hard component and an elastomer perform well. They represent an important sector of the rubber industry. Such composites are found in a wide variety of applications, for example, as shock-absorbing bearings in the chassis of motor vehicles, buffers or reinforced seals in engines and machines.

Traditionally, hard components consisted of metal composites. To reduce weight, particularly in vehicles, more and more metal components are being replaced by suitable plastic parts wherever possible. This has two additional advantages: Plastics do not corrode and can be efficiently processed into very complex moldings by injection molding. However, they must be dimensionally stable at the usual vulcanization temperatures of 160-190°C. The manufacture of such complex parts from metal is very expensive. The use of plastics in the design of complex components provides the designer and component developer with much greater latitude.

For the long-term function of composites, particularly under dynamic stress, the adhesion between the hard component and the soft component of the composite is an important criterion. It is usually achieved by adhesion promotors. Combinations of all standard rubber types with most metals and simple plastics are possible. Besides additional process steps for applying the adhesion promoter, protective measures against emissions of the usual solvents and their environmentally correct disposal are required.

Adhesion without adhesion promoters

By contrast, the plastic-rubber composite patented by Evonik obviates adhesion promoters. Stable, permanent bonds to suitable rubber blends can be produced without special pre-treatment using the specialty compounds.

Composites with VESTAMID® HT*plus*

Our latest development exploits the high heat deflection temperature of more than 280°C and dimensional stability of VESTAMID® HT*plus*, especially in the range of 120 to 140°C, and adds the special functionality of direct bonding to a variety of elastomers. Compared with PA 66 and PA 612, VESTAMID® HT*plus* features also higher strength and stiffness, especially in contact with moisture, a high long-term heat resistance up to 150°C, and a low tendency to creep. Due to higher heat deflection temperature of PPA compared to PA 612 it is possible to vulcanize also thin thermoplastic parts together with rubber up to 190°C without any deformation of the plastic part.

For direct rubber bonding three heat-stabilized grades are available:

- VESTAMID® HT*plus* R1033 and
- VESTAMID® HT*plus* R1133 are 30% glass fiber-reinforced,
- VESTAMID® HT*plus* R1035 contains 50% glass fibers.

These compounds are especially for manufacturing parts subjected to high temperature.

Bonding behavior against different rubbers

Rubber	VESTAMID® HT*plus*		
	R1033	R1133	R1035
ACM	+ P, A	+ P, A	*
AEM	++ A	+++ A	* A
FPM	++ P	+ P	+ P
EPDM	*	+ P	*
NBR	*	*	*
H-NBR	+++ P	*	+++ P
X-NBR	*	+ P	*
VMQ	++ P	++ P	*

P = peroxide A = amine * = under evaluation

Values are based on testing of press plates. Adhesion results will be updated continuously. The results are evaluated on rubber recipes described in our brochure *High-Performance Polymers in Plastic-Rubber Composites.* In general, we recommend testing your recipes in our labs.

Important properties of VESTAMID® HT*plus* compounds for plastic-rubber composites

Property	Test method	Unit	VESTAMID® HT*plus*		
			R1033	R1133	R1035
Glass fiber content		%	30	30	50
Tensile test	ISO 527-1/2				
Tensile strength		MPa	180	140	260
Strain at break		%	2.0	1.5	1.8
Tensile modulus	ISO 527-1/2	MPa	11000	10500	17000
CHARPY impact strength 23°C	ISO 179/1eU	KJ/m²	45 C	29 C	70 C
-40°C			30 C	23 C	50 C
CHARPY notched impact 23°C	ISO 179/1eA	KJ/m²	7 C	6 C	12 C
strength -40°C			7 C	6 C	12 C
Vicat softening temperature	ISO 306				
Method A..... ...10 N		°C	308	300	308
Method B 50 N		°C	275	275	282
Melt temperature		°C	330-340		
Mold temperature		°C	140-180		

C = complete break

www.vestamid.com
Evonik Industries AG High Performance Polymers 45764 Marl Germany
PHONE +49 2365 49-9878 **E-MAIL** evonik-hp@evonik.com

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