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Technical data sheet

New type inorganic flame retardant synergist RTP-501

Overview: RTP-501 is a new type of superfine powder additive inorganic flame retardant synergist with excellent performance. It is a mineral powder material that is made of wollastonite 600 meters below ground, through high-tech surface treatment agents and nano-modification technology, and was jointly developed by the R&D team of our company, Tsinghua University and relevant China national academicians.

Product advantages:

1. Reduce customer's production cost.
2. little of non-eco ingredients.
3. Reduction of product density
4. Reduce the amount of titanium dioxide needed for light-colored products.
5. Shorten the process of injection molding.
6. Increase the heat distortion temperature of the final product

Main ingredients: Magnesium Oxide/Silica/etc

Properties: This product is a white powder, whiteness > 98%, average particle size 1.1um, loss on ignition < 5. It has the characteristics of high whiteness, high fineness, and high purity. It has a large specific surface area, and the surface effect and volume effect of ultra-fine particles. No skin irritation, no odor, and no corrosion.

Application range: suitable for PA, PBT, PP, PET, ABS, PVC and PC/ABS.....

Usage: This product is a new type of superfine additive inorganic flame retardant with excellent performance.

It can be used:

1. in halogen + antimony trioxide flame retardant system, to replace part of antimony trioxide.
2. in antimony trioxide flame retardant system alone (no halogen flame retardant involved), to replace part of antimony trioxide.

Thermal decomposition temperature of RTP501 is 340°C.

Thanks to its special surface treatment, RTP501 achieves excellent compatibility and adhesion with plastic resins, has a great viscosity reduction effect;

RTP501 has good dipping performance with glass fiber and thus less mixing time ;
Allow good flowability and molding performance of the compound.

When used together with Sb₂O₃, the dosage of Sb₂O₃ can be greatly reduced, while >90% of the mechanical properties can be maintained.

Thanks to the high whiteness of RTP501, the amount of titanium dioxide (TiO₂) needed for the production of white products can also be reduced, thus furtherly help cutting customer's production cost.

Flame-retardant mechanism: This product can play an acid catalysis effect during the combustion of polymers, making the whole system partially cross-linked and carbonized, thus forming a char protective layer, to prevent the release of volatile decomposition products. At the same time, RTP-50 can also reduce the decomposition temperature of antimony oxyhalide generated during the reaction between halogen flame retardants and Sb₂O₃, so as to achieve



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the purpose of assisting flame retardancy.

Features:

1. Excellent high-temperature resistance and thermal stability. TGA is only 0.5%wt within 400°C.
2. Good compatibility with modified plastic products such as PA, PBT, PP, PET, ABS, PVC and PC+ABS alloy, therefore the mechanical properties of the final products can be well maintained.
3. RTP501 can replace Sb₂O₃ by 40%~60%wt, and at the same time no influence to the flame retardant performance. Thus saving much production costs.

4. With no more than 3% addition of RTP501, flowability of the plastic compound can be significantly improved, thereby improving the dimensional stability and surface smoothness of the final product.

RTP501 can also help significantly improve the electrical properties (dielectrical strength and CTI) of the product.

RTP501 can help maintain the mechanical and electrical properties of the product under high temperature and high humidity circumstances.

Test data on the following pages ↓↓↓



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RTP-501 application data in bromine-antimony based flame retardant modified plastics

Table 1: RTP501 used in PBT (formulas)

	1	2	3	4	5
PBT%	58	57.5	57.5	57.5	57
DBDPE%	9	9	9	9	9
Sb ₂ O ₃ %	3	2	1.5	1	0
RTP-501%	0	1.5	2	2.5	4
Other additive	5	5	5	5	5

Table 2: RTP501 used in PBT (test results)

	Test standard	1	2	3	4	5	unit
Tensile strength	GB/T1040-1992	104	107	106	108	106	MPa
Elongation at break	GB/T1040-1992	2.1	2.3	2.4	2.2	2.6	%
Bending strength	GB/T9341-2000	137	136	139	140	139	MPa
Bending modulus	GB/T9341-2000	7981	8106	7930	8008	8219	MPa
Notched impact strength	GB/T1843-1996	8.2	8.4	8.5	8.4	8.6	KJ/m ²
HDT	GB/T1634-2004	219	221	220	218	219	°C
Melt index	GB/T3682-2000	27.3	31	32.5	34.1	37	g/10min
FR grade	UL-94	V-0	V-0	V-0	V-1	HB	/
Ash content	GB/T9345-1988	24.3	25.1	25.5	24.8	25.3	%



Table 3: RTP501 used in PA66
 (formulas)

	6	7	8	9	10
PA66%	56.5	56	55.5	55.5	55.5
DBDPE%	10	10	10	10	10
Sb2O3%	3.5	3	2.5	1.5	0
RTP-501%	0	1	2	3	4.5
Other additive	5	5	5	5	5
GF%	25	25	25	25	25

Table 4: RTP501 used in PA66 (test results)

	Test standard	6	7	8	9	10	unit
Tensile strength	GB/T1040-1992	144	150	149	153	155	MPa
Elongation at break	GB/T1040-1992	2.8	2.6	2.9	3.1	3.0	%
Bending strength	GB/T9341-2000	183	195	191	197	196	MPa
Bending modulus	GB/T9341-2000	7670	7809	7783	7841	7952	MPa
Notched impact strength	GB/T1843-1996	15.3	16.1	16.2	16.7	17.1	KJ/m2
HDT	GB/T1634-2004	253	255	254	255	253	°C
Melt index	GB/T3682-2000	/	/	/	/	/	g/10min
FR grade	UL-94	V-0	V-0	V-0	V-1	HB	/
Ash content	GB/T9345-1988	25. 6	24. 8	25. 3	24. 9	25. 5	%

RTP-501 used in PA66 and PBT: discussion and conclusion

According to the dosage table 1, 3 and sample test result table 2, 4, we can find similar changes after adding RTP-501 into PBT and PA66 FR systems respectively. The most significant change is the enhanced MFR(melt flow rate) with the increased dosage of RTP-501, while other mechanical properties are basically unchanged, which is good for the later molding process.

Moreover, when half the dosage of Sb2O3 is replaced by RTP-501, the FR performance is well maintained. But RTP-501 can not yet completely replace Sb2O3 in Br-FR systems.

RTP-501 is an inorganic powder, more eco-friendly than Sb2O3. Most importantly, RTP-501 price is just about 1/6-1/5 the price of Sb2O3. And RTP-501 production

is not dependent on the expensive antimony resources, thus can largely reduce the



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customer's cost for FR-treatment of PA66 and PBT, gaining customers the upper hand in market competition.

In addition, PA66 added with RTP-501 is whiter than with Sb2O3 alone, with enhanced physical appearance and coloring performance.

Table 5: RTP501 used in ABS (formulas)

	11	12	13	14	15
ABS%	81	80	80	80	80
DBDPE%	12	12	12	12	12
Sb2O3%	4	3	2	1	0
RTP-501%	0	2	3	4	5
Other additive	3	3	3	3	3

Table 6: RTP501 used in ABS (test results)

	Test standard	11	12	13	14	15	unit
Tensile strength	GB/T1040-1992	39.3	41.0	40.7	40.8	41.5	MPa
Elongation at break	GB/T1040-1992	18.6	21.3	20.3	23.8	21.6	%
Bending strength	GB/T9341-2000	58	57	60	58	61	MPa
Bending modulus	GB/T9341-2000	2491	2511	2485	2527	2508	MPa
Notched impact strength	GB/T1843-1996	12.1	12.4	12.2	12.6	13.2	KJ/m2
Melt index	GB/T3682-2000	3.1	4.2	4.8	5.9	6.5	g/10min
FR grade	UL-94	V-0	V-0	V-0	V-1	HB	/
Density	GB/T1033-1986	1.20	1.18	1.16	1.15	1.13	g/cm3



RTP-501 used in ABS: discussion and conclusion

According to the dosage table 5 and sample test result table 6, we can find enhanced MFR(melt flow rate), enhanced notch impact strength, and significantly lower material density with the increased dosage of RTP-501.

Moreover, when half or less the dosage of Sb₂O₃ is replaced by RTP-501, the FR performance is well maintained.

Besides, ABS added with RTP-501 is whiter than with Sb₂O₃ alone, and has better coloring performance.

Table 7: RTP501 used in PP (formulas)

	16	17	18	19	20
PP%	60	58.5	58.5	58.5	58.5
DBDPE%	18	18	18	18	18
Sb ₂ O ₃ %	6	4.5	3	1.5	0
RTP-501%	0	3	4.5	6	7.5
其它	16	16	16	16	16

Table 8: RTP501 used in PP (test results)

	Test standard	16	17	18	19	20	unit
Tensile strength	GB/T1040-1992	24.3	23.7	25.5	25.3	24.2	MPa
Elongation at break	GB/T1040-1992	32	36	35	41	38	%
Bending strength	GB/T9341-2000	36	38	36	35	37	MPa
Bending modulus	GB/T9341-2000	2209	2187	2241	2133	2270	MPa
Notched impact strength	GB/T1843-1996	3.6	3.9	3.8	4.2	4.2	KJ/m ²
Melt flow index	GB/T3682-2000	9.4	11.1	11.9	13.4	15.7	g/10min
HDT	GB/T1634-2004	130	132	132	133	134	°C
FR grade	UL-94	V-0	V-0	V-1	V-1	HB	/
Density	GB/T1033-1986	1.23	1.20	1.19	1.17	1.14	g/cm ³



RTP-501 used in PP: discussion and conclusion

According to the dosage table 7 and sample test result table 8, we can find enhanced MFR(melt flow rate), enhanced notch impact strength, and significantly lower material density with the increased dosage of RTP-501.

And, when 1/3 or less the dosage of Sb2O3 is replaced by RTP-501, the FR performance is well maintained.

Moreover, PP added with RTP-501 is whiter than with Sb2O3 alone, with enhanced surface glossiness and coloring performance.

Besides, as RTP-501 is an ultra-fine inorganic powder, it can perform nucleation effect in PP compounding, reducing the molding cycle, improving material distortion temperature. At the same time it can reduce the dosage of special nucleating agent in the compounding process, thus furtherly reducing the production cost.

Table 9: RTP501 used in HIPS (formulas)

	21	22	23	24	25
HIPS%	79	78.5	78.5	78	78
DBDPE%	13	13	13	13	13
Sb2O3%	4.5	3	2	1	0
RTP-501%	0	2	3	4.5	5.5

Table 10: RTP501 used in HIPS (test results)

	Test standard	21	22	23	24	25	unit
Tensile strength	GB/T1040-1992	24.3	25.1	24.8	25.1	25.3	MPa
Elongation at break	GB/T1040-1992	49	61	52	60	69	%
Bending strength	GB/T9341-2000	43	45	43	47	44	MPa
Bending modulus	GB/T9341-2000	2180	2231	2209	2287	2313	MPa
Notched impact strength	GB/T1843-1996	11.8	12.3	12.4	12.7	12.6	KJ/m2
Melt index	GB/T3682-2000	8.8	9.3	9.4	9.7	9.6	g/10min
FR grade	UL-94	V-0	V-0	V-1	HB	HB	/
Density	GB/T1033-1986	1.15	1.13	1.12	1.10	1.09	g/cm3

RTP-501 used in HIPS: discussion and conclusion

According to the dosage table 9 and sample test result table 10, we can find similar effect of RTP-501 added into HIPS, compared with RTP-501 added into ABS.



RTP501 used in PVC wire and cable (formulas)

	1	2	3	4
PVC(K=71-72)	100	100	100	100
DOP	35-40	35-40	35-40	45-50
Chlorinated Paraffin-52	14-18	14-18	14-18	14-18
Calcium Carbonate	30-50	30-50	30-50	30-60
Heat Stabilizer	3-5	3-5	3-5	3-5
Sb ₂ O ₃	1. 5	2	2.5	1.5
RTP-501	1. 5	2	2.5	1.5
LOI%	28-29	29.5-30.5	31.5-32.5	27-28

Conclusion

As a new type inorganic powder additive-type flame retardant, RTP-501 can partly replace Sb₂O₃ in the bromine-antimony based flame retardant modification of many plastic types.

While reducing customer's production costs, it can also significantly improve the processability of materials. And can to some extent improve some of the mechanical properties of the modified plastic.

With the fast development of modern society, requests and expectations on modified plastics continue to increase. And the continuous consumption of Metal mineral resources, which are non-renewable, their quantities are decreasing year by year due to increasing human consumption.

RTP501, as a new type additive, can help ease the consumption of precious mineral resources (antimony), and much more eco-friendly than antimony, thus worthy of customer welcome and acceptance.