Wacker Chemie AG Hanns-Seidel-Platz 4, 81737 Munich, Germany
Tel. +49 89 6279-0, www.wacker.com

WACKER WORLD WIDE MAGAZINE

WWW

WACKER.COM/WWW-MAGAZINE

WACKER

INTEGRATED FIRE PROTECTION

Aluminum composite panels used on building exteriors have a plastic core that contains fire-retardant fillers. To make these compounds easier to process, a silicone additive, GENIOPLAST® Pellet S, is added.

It's a difficult conflict to resolve: although safety is one of our basic human needs, we generally do not want to be made aware of safety precautions. Safety should be a given and, ideally, invisible. Take fire safety, for example: while fire extinguishers, smoke detectors and sprinkler systems convey a sense of security when we see them, they also remind us that the potential danger is real, and taint our sense of security with ambivalence. Fire safety is not the only requirement that needs to be met in building construction – energy, design and economic factors have to be harmonized as well. In modern building construction, aluminum composite panels have become an established component of exterior surface design. Their advantages are obvious: they are easy to transport and process, and can be incorporated into virtually any design through the use of appropriate exterior coatings. They also stand up to inclement weather, and with an insulating layer, they act as a thermal barrier.

PLASTIC CORE FOR INSULATION

Yet this is where a particular challenge presents itself: in order to ensure that the aluminum panels do not act as a cold bridge and encourage heat loss, an insulating plastic layer is sandwiched between two aluminum layers. This layer, which is typically made of polyethylenes, thermally separates the two outer panels from one another. Polyethylenes, however, are flammable. To ensure that the panel's fire-safety characteris-

Customized aluminum composite panels can be made to fit the contours of any building exterior, such as those of these modern apartment buildings in the Netherlands.

WWW ▸ SPECIAL ▸ **PLASTICS TECHNOLOGY**

Pelletized GENIOPLAST® silicone additive with a silicone content of 70%.

tics do not suffer as a result, fire-retardant fillers such as aluminum or magnesium hydroxide are incorporated. “These can account for up to 70% of the polyethylene layer,” says Dr. Klaus Pohmer, director of Global Business Development at WACKER’s Performance Silicones business unit. “Polymers with this much filler are more difficult to process.”

As a result, pressure mounts at the extruder head, which can lead to decomposition of the aluminum hydroxide. Not only does the machine’s electricity consumption shoot up as a result; the thermal stress on the compound rises too – so much, in fact, that some of the aluminum hydroxide breaks down. Furthermore, die drool forms at the extruder head as material collects unchecked at the edge of the die.

These problems can be solved, however. Compounds are used wherever well-known, pure plastics do not possess the desired properties. Developing new, specialty plastics is a complex, costly process, and manufacturers would prefer to alter established materials such as polyethylene and polypropylene with fillers and additives to suit the application. This approach generally produces quicker results, yielding plastics that have been optimized, for instance, for light fastness, surface properties, physical and chemical stability, or, of relevance here, flame retardancy.

SILICONE ADDITIVES IMPROVE MATERIAL CHARACTERISTICS

Additives for thermoplastic compounds such as these – which are used not only in aluminum composite panels, but also in cable sheathing – can include simple materials such as calcium carbonate and talc, as well as complex organic compounds. Silicone additives are gaining in importance, especially because they improve the processing properties of the material, reducing friction and thus making thermoplastics easier to process. Compared to organic additives with a similar effect, they are thermally stable.

GENIOPLAST® Pellet S from WACKER can easily be incorporated into a diverse range of thermoplastic compounds. This silicone additive consists of a pelletized, highly

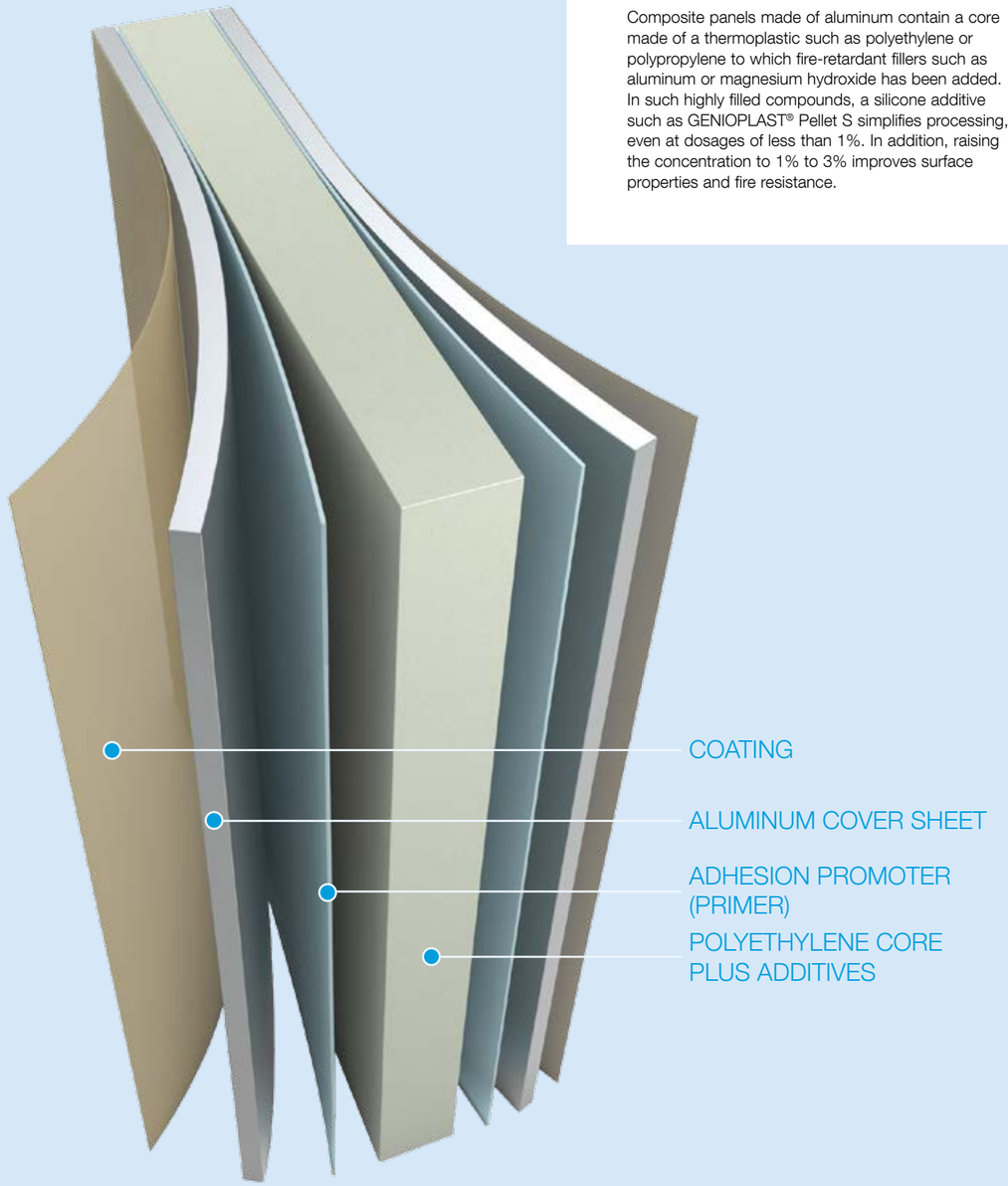
Compounds are used wherever pure plastics do not possess the desired properties.

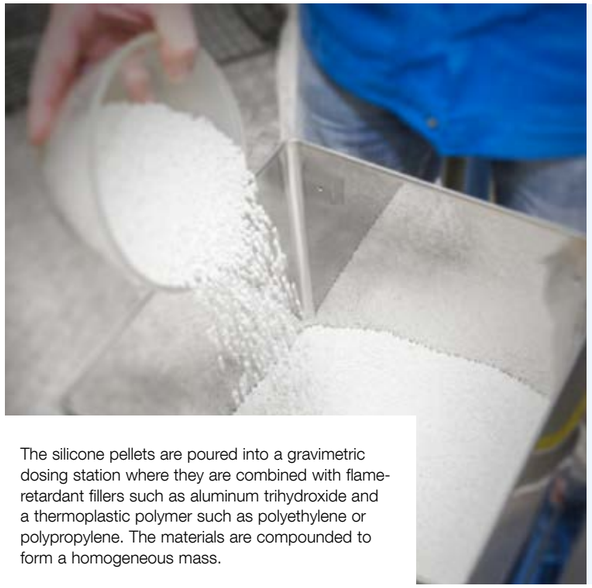
PODCAST

Listen to our podcast to find out about the use of GENIOPLAST® Pellet S in automotive interior trims.

ALUMINUM COMPOSITE PANELS

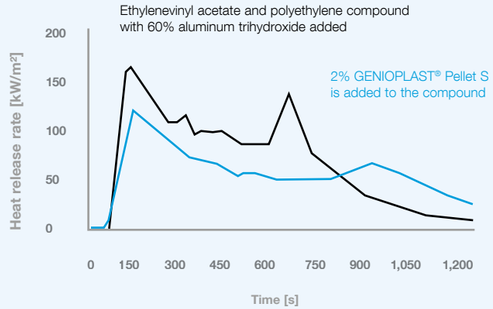
Composite panels made of aluminum contain a core made of a thermoplastic such as polyethylene or polypropylene to which fire-retardant fillers such as aluminum or magnesium hydroxide has been added. In such highly filled compounds, a silicone additive such as GENIOPLAST® Pellet S simplifies processing, even at dosages of less than 1%. In addition, raising the concentration to 1% to 3% improves surface properties and fire resistance.





The silicone pellets are poured into a gravimetric dosing station where they are combined with flame-retardant fillers such as aluminum trihydroxide and a thermoplastic polymer such as polyethylene or polypropylene. The materials are compounded to form a homogeneous mass.

Calorimetry of Cable Compounds



Plastic compounds comprising polyolefins, fire-retardant additives and GENIOPLAST® Pellet S, used for for example for cable sheathing, release less heat upon combustion than do compounds without a silicone additive.

An English-language video describing the performance of GENIOPLAST® silicone additives can be found here:

www.wacker.com/genioplast

Development engineer Oliver Fuhrmann observes the discharge of molten compound into the water quench.

Thanks to GENIOPLAST® Pellet S, the highly filled material leaves the extruder die without any die drool whatsoever – despite the tremendous pressure and heat applied.

concentrated silicone polymer formulation (silicone content: 70%) and a pyrogenic silica carrier, whose properties are tailored to the specific polydimethylsiloxane being used. GENIOPLAST® is processed by simply adding it to the base polymer in a twin-screw extruder or a co-kneader, and then extruding it. Pyrogenic silica ensures that the additive is compatible with all thermoplastics and thermoplastic elastomers.

GENIOPLAST® Pellet S simplifies processing in highly filled, flame-retardant compounds, even at concentrations of less than 1%. In addition, raising the concentration to 1% to 3% improves the surface properties and fire resistance of the corresponding plastics. Through extensive testing, for instance, WACKER was able to verify two highly desirable properties. First, lower heat generation: in polyolefin compounds (such as polyethylene and polypropylene) that contain fire-retardant fillers, GENIOPLAST® Pellet S reduces the heat released in a fire. Second, smoke suppression: GENIOPLAST® Pellet S prevents the fire from being stoked any further and reduces the formation of hazardous smoke.

ENHANCED FIRE-PREVENTION PROPERTIES

Cone calorimetry – an important test method for fire performance – shows that when a compound containing GENIOPLAST® Pellet S combusts, the release of heat is spread out over a longer period of time, the peak value of heat generation drops, the overall heat output is reduced and less smoke is formed. This is due to the ash, which is more compact and less brittle, and which deposits on the burning material as a crust. “The combustion residue of compounds containing GENIOPLAST® Pellet S prevents polymer oxygenation and heat transfer,” Pohmer explains. “Both effects help prevent fires from spreading rapidly.”

GENIOPLAST® Pellet S thus does an excellent job of intensifying the effect of flame-retardant fillers such as aluminum trihydroxide. This, along with its ability to simplify processing, makes GENIOPLAST® Pellet S an ideal additive for highly filled polymers designed to impede the impact of fires. These are two real advantages – one increases efficiency in production, the other can save lives.

What’s more, when integrated into aluminum composite panels used for siding, GENIOPLAST® Pellet S even makes fire protection invisible. ■

CONTACT

For more information on this topic, please contact:

Dr. Klaus Pohmer
Global Business Development
Performance Silicones
Tel. +49 89 6279-1315
klaus.pohmer@wacker.com