SPECIALIST ARTICLE

menzerna
polishing compounds

This newsletter appears several times a year, informing industry costumers with interesting news and innovations from Menzerna.

Aluminium polishing: spontaneous combustion of polishing wastes

New generation of polishing pastes reduces the risk by 90 %

Ötigheim, April 2017

Contact

Menzerna polishing compounds GmbH & Co. KG

Industriestraße 25

D- 76470 Ötigheim

Phone: +49 (0)7222/9157-0

Mail: industry@menzerna.com

www.menzerna.com

Risk in aluminium polishing: polishing / sanding wastes can self-heat and spontaneously combust without the influence of an ignition source or sunlight. Storage under water can only suppress the fire temporarily. If the waste dries on the surface, the spontaneous combustion reaction can recur. The causes for this are now known. New Menzerna polishing pastes reduce the risk of the spontaneous combustion of aluminium polishing wastes by 90 %.

The most important insights at a glance:

- Waste produced during the polishing of aluminium is prone to spontaneous combustion
- Aluminium sanding waste increases the spontaneous combustion potential
- The risk of spontaneous combustion can be reduced by 90 % with the Menzerna HAT additive in the polishing paste
- Safe handling of polishing waste must be anchored in an operational concept for protective measures as part of purposeful hazard prevention
- Polishing waste should stay in the wet scrubber for 24 hours prior to dry disposal
- No mixing of polishing wastes with and without additive

Perfection in Polishing.
Made in Germany.
Since 1888.

Menzerna develops and produces polishes for industry and trades, automobile clear coats and gel coat surfaces of premium quality.

Situation in aluminium polishing operations

When operations sand and polish aluminium, hazardous waste is produced. It consists of cotton fibres from the polishing ring and aluminium particles as well as fats and oils from the polishing emulsions, polishing minerals and water. The sanding and polishing dust is usually extracted via wet scrubbers. Then it is stored in open containers outside the building. This often leads to fires, either in the container, on the disposal company's lorry, or directly in the production hall. The exact causes for this were previously unclear. This hazard potential has been insufficiently considered in operational hazard analyses so far.

The cause of spontaneous combustion: highly reactive aluminium particles

What does the spontaneous combustion of polishing wastes in aluminium polishing mean? Spontaneous combustion means the ability of a substance to continuously self-heat through a chemical reaction and to finally ignite. The spontaneous combustion mechanism is as follows: The polishing agent consists of water, fused alumina and the bond (oils, fats and waxes). During the sanding and polishing of aluminium, it is enriched with additional substances. These are fine, non-oxidised aluminium particles and cotton fibres. Because of the metal dust it contains, the chemical reaction potential of the waste is high. It can react with atmospheric oxygen while self-heating.

Large reaction surface and high combustion heat

The small reactive aluminium particles offer a large reaction surface for the reaction partners. These include for example fats, water or atmospheric oxygen. Unsaturated oils and fats also have a high-energy potential. The combustion heat of aluminium is very high at 31 kJ/g. It is much higher than that of brown coal (19 kJ/g) and paper (15 kJ/g). In addition, the cotton fibre residues of the polishing ring make very good thermal insulation. This means reaction heat can accumulate in the polishing waste. Chemical reactions speed up as a result. This leads to a chain reaction that can end in a fire. A great risk for operations that polish aluminium.

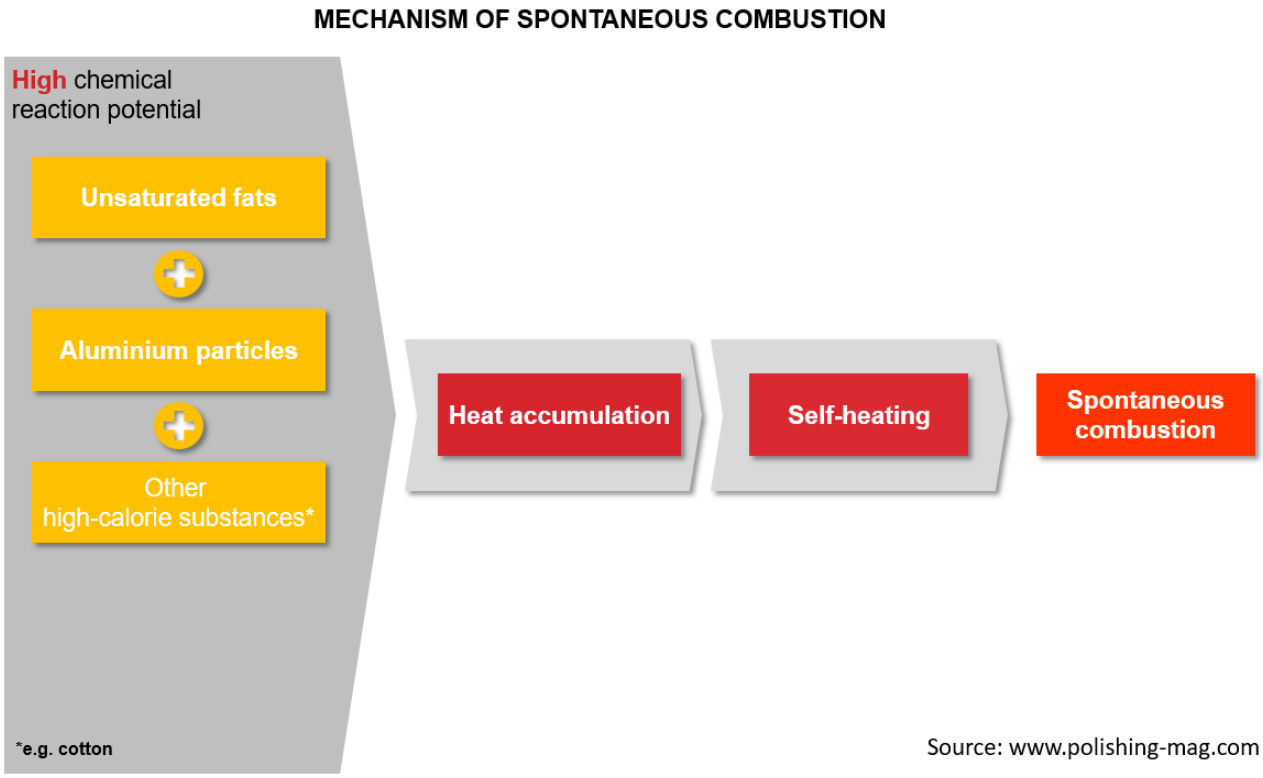

Figure 1: Illustration of the mechanism: spontaneous combustion of aluminium polishing wastes

ARC process proves self-heating of the aluminium polishing waste

The ARC (Accelerated Rate Calorimetry) process is a thermal analysis method. It can be used to prove the self-heating of aluminium polishing waste. A dried polishing waste sample is filled into a metal bomb for this purpose. The sample is continuously heated in the heating chamber. In doing so, the temperature of the polishing waste in the bomb is measured regularly. This temperature is compared to the temperature in the heating chamber to see if they correspond. When the temperature of the polishing waste is higher, the sample temperature is adjusted. The reaction potential of the polishing waste can be illustrated graphically. The flatter the curve progression, the less it tends towards self-heating and spontaneous combustion.

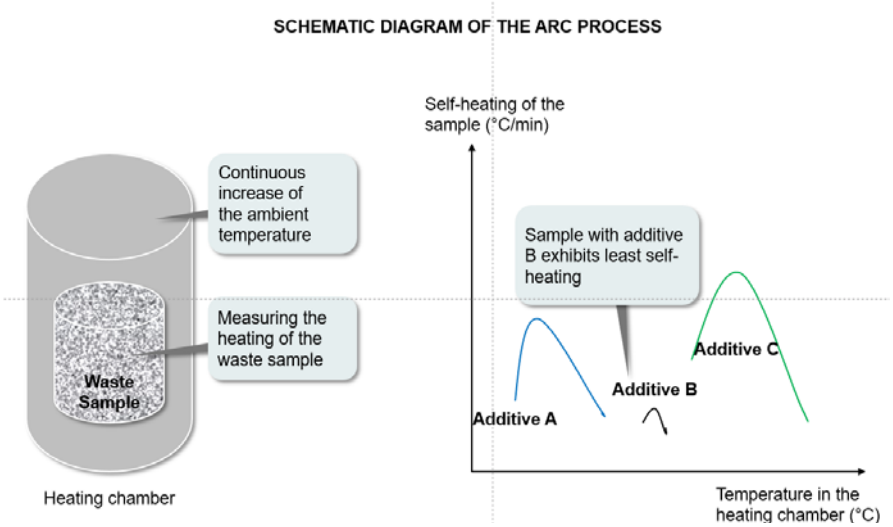

Fig. 2: Schematic diagram of the ARC process

Additive in the polishing paste reduces the spontaneous combustion risk by 90 %

Thus the chemical processes and modes of action within the aluminium polishing waste have been deciphered. Measures can therefore be developed to counteract self-heating of the polishing waste. Incorporating an additive into the Menzerna polishing paste formulation neither has a negative impact on the polishing performance nor on the polishing result. Its positive effect only comes to bear in the polishing waste. The additive absorbs the reactive components of the mixture in the wet scrubber. This eliminates heat accumulation and also self-heating of the waste. The likelihood of spontaneous combustion is reduced by 90 %. This is because the additive interferes directly with the aluminium particles' mode of action in polishing waste. The aluminium reacts fully and effectively. Thus no more energy can contribute to spontaneous combustion.

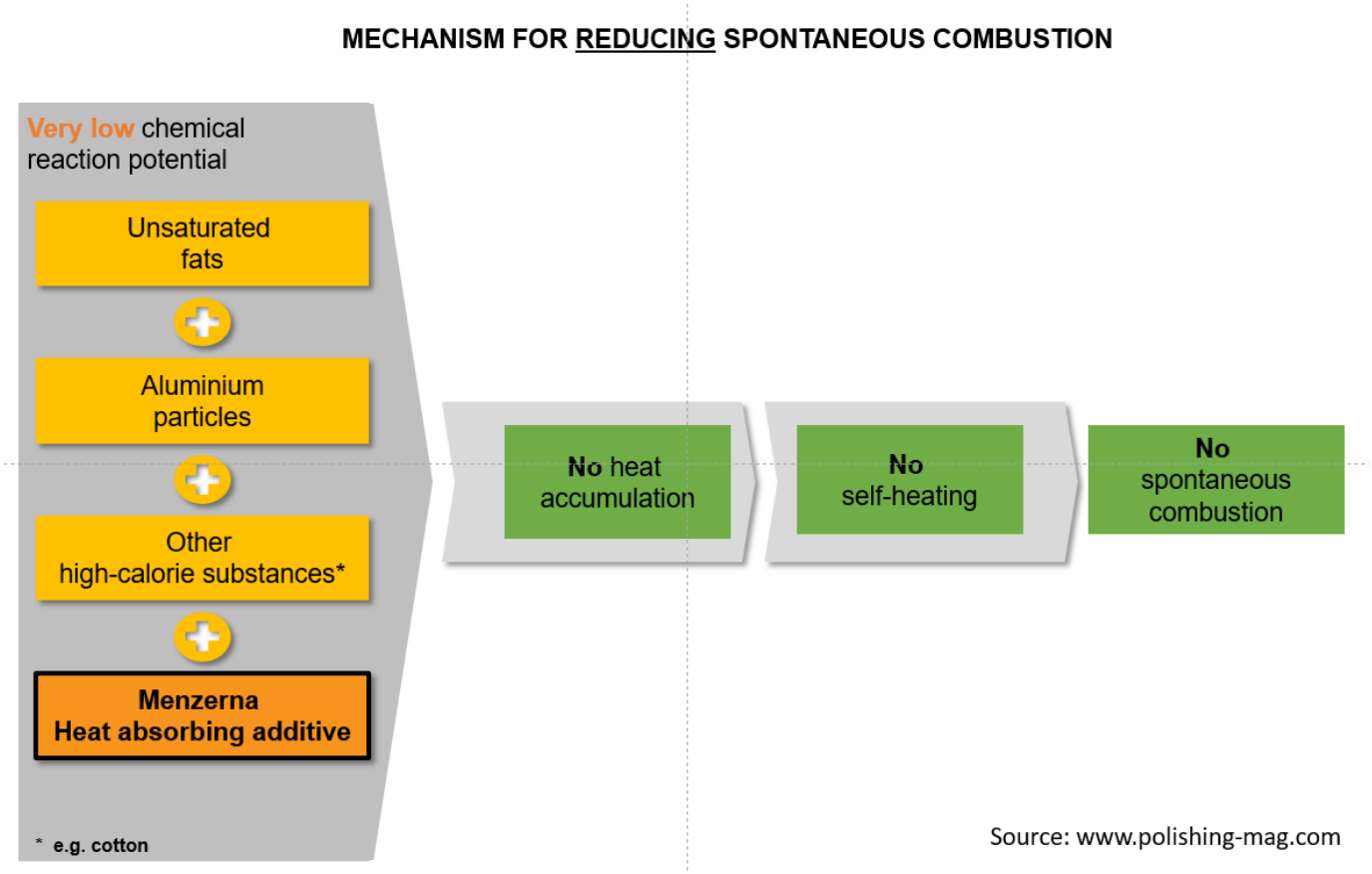

Figure 3: Illustration of the mechanism: reducing the spontaneous combustion of aluminium polishing wastes

Basic conditions for the effect of the additive

To ensure the effect of the additive, the following basic conditions have to be met in the polishing of aluminium. The polishing waste should remain in the wet scrubber for 24 hours. Only then is the waste ready for safe dry disposal. Longer holding times improve the effect of the additive. Shorter times reduce the effect. When the reaction temperature (water temperature in the wet scrubber) is approximately 10 ºC higher, the reactivation speed doubles. The effectiveness of the additive for magnesium or zinc alloys has not been investigated yet. Only polishing waste of one kind may be fed into a wet scrubber in a polishing operation. Polishing waste with and without the additive should not be mixed. Otherwise the effect is weakened.

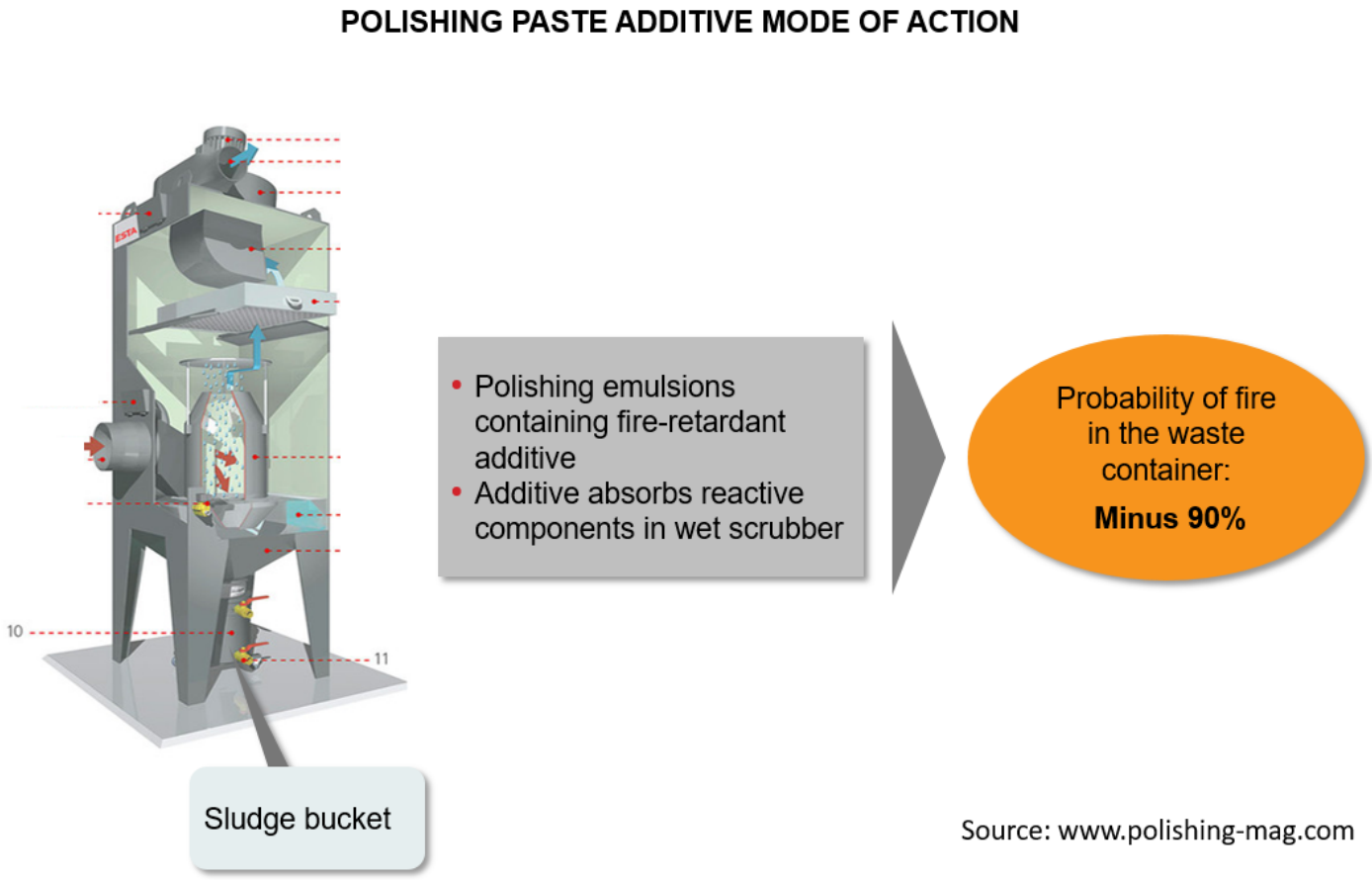

Figure 4: The polishing paste additive mode of action to reduce the spontaneous combustion of aluminium polishing waste

Benefits for industrial enterprises that polish aluminium

The risk of a fire is significantly reduced. Costs for unnecessary fire brigade deployments are eliminated. Proper handling of polishing wastes is part of an effective concept for protective measures as part of hazard prevention. Disposal of the waste by disposal companies becomes much safer. Disposal costs can be significantly reduced due to dry instead of wet disposal of the waste.

Field tests by large-scale customers to confirm the effect of the additive

Confirming the tests conducted in the Menzerna technical centre is the next step. Field tests with Menzerna polishing pastes enriched with the additive are being conducted in mid-2017. They will be tested in isolated polishing systems of large-scale operations that polish aluminium. Large quantities of aluminium sanding and polishing wastes are produced here. Polishing waste samples will be subsequently collected. These will be compared to conventional waste without the additive in the ARC process. Thus the effect of the additive can be clearly proven. Menzerna keeps you up to date.

Conclusion

Risk in aluminium polishing: aluminium polishing wastes can spontaneously combust. The causes have been deciphered exactly and suitable measures have been developed. By incorporating an additive, the risk of fire can be reduced by 90 %. There is also a significant cost reduction potential for aluminium processing operations.

The Author

Menzerna gets to the bottom of things. Through extensive tests on the robot-assisted sanding and polishing system in the Menzerna technical centre, the secret of the spontaneous combustion of aluminium polishing wastes has now been deciphered. A scientific institute specialising in energetic materials supported Menzerna Application Technology in this process. Innovative polishing pastes with the Menzerna Heat Absorbing Technology (HAT) could be developed as a result. These can significantly reduce the risk of polishing waste ignition in industrial polishing processes, making them an important element of an operational concept for protective measures.