



## INDUSTRY APPLICATIONS OF DEGREASING PROCESS

### PRIEMYSELNÉ APLIKÁCIE ODMASTŇOVACIEHO PROCESU

Anton PANDA - Lukáš ANDROVIČ

**Abstract:** Degreasing is an important process especially in case where the surface treatment of the component is necessary. In order for surface treatment to keep its properties during the given process, it is necessary to ensure proper surface tension of the component by application for example of paint or varnish, but also metallization such as galvanization, etc.[1]

**Key words:** Degreasing, cleaning, process, surface tension

#### Introduction - degreasing process

Degreasing of the metal products before the paint and varnish applications is as important as removal of the rust. It increases the adhesion of the decorative coat- layer, prevents corrosion and significantly increases the service life. Ongoing progress of technologies offers many answers how to degrease the surface before paint coat application and ensures the possibility for high quality surface treatment. Process of degreasing includes removal of contaminants which are part of polishing mediums, oils and coolants from the metal surface.[1]

#### Definition of degreasing process

There are two kinds of degreasing process. Mechanical, where the layer of grease and impurities is mechanically removed from the surface. The second kind is chemical where the removal of the grease and impurities is done by series of chemical reaction. Of course these two methods can be combined to increase the effectiveness of the degreasing process. It is also important to know at the beginning what kind of material we need to degrease as well as the degree of the product surface contamination.[1]

#### Mechanical degreasing

The process of mechanical degreasing (**Fig. 1**) is more time consuming, but less expensive. This method enables to achieve the degreased surface with good properties for adhesion of another layer such as paint or varnish. The mechanical cleaning is done either manually or by using machine. The classic machine method is for example grinding of the surface layer or sand blasting. Although these methods are cheap they are time consuming and in most cases a very thin top layer of the surface is removed together with the contaminants. Mechanical degreasing is often combined with some form of chemical degreasing, for example washing in the washing machines where we can use the abrasives together with the chemicals.[1]

#### Chemical degreasing

This method of degreasing is less time consuming especially since we can chemically degrease several components at the same time. It also does not require special skills or physical strain of the operator like manual mechanical degreasing.[1]



Fig. 1 Mechanical degreasing[4]

The most often used methods of chemical degreasing are:

- Solutions
- Ultrasound
- High pressure cleaning
- Steaming

### Degreasing solutions

Today's market offers variety of degreasing solutions. Based on the principle of their functioning we can divide them into two basic groups: emulsifying and non-emulsifying. These subsequently can be divided into organic, alkaline, acidic, emulsive, etc. Each of them offers different degreasing properties and application suitability for different materials. Degreasing solutions are suitable for components with shape complexity.[1]

### Emulsifying solutions

Emulsifying solutions work on the principle of absorbing the impurities from the contaminated surface of the material. Its main advantage is that the component can be simply submerged in the solution and let the solution absorb the impurities. The disadvantage is that we have to monitor the impurities saturation value of the solution. When the saturation is high, the solution loses its effectiveness and cleaning properties and instead of cleaning it starts to contaminate the submerged components. Because of that the quality of degreasing depends on saturation of the solution. When the solution gets saturated it simply needs to be changed.[1]

### Non-emulsifying solutions

Non-emulsifying solutions work by expelling the impurities from the surface of the component. This method can be combined with the use of ultrasound. Ultrasound produces the vibration which speeds up the expulsion of the impurities from the surface of the component. Also this way we can clean several components at the same time. The main disadvantage is that removed impurities rise to the surface and form coherent film, that needs to be interrupted before the component is removed from the solutions. If it is not done this



way the impurities collected on the surface of the solution will again contaminate the surface of the component on its way out of the solution.[2]

### Degreasing by Ultrasound

Ultrasound is used to increase the efficacy of the degreasing solutions (**Fig. 2**). The surface of the component is cleaned by cavitation bubbles that penetrate under the film of the microcastic impurities that subsequently peel off. This method is used mainly in cases where there are higher requirements for the quality of the component surface such as engine parts, precise components, jewelry. Most of the time it is used for complex shaped components.[2]



Fig. 2 Ultrasound degreasing[5]

### High pressure cleaning

Its main advantage is speed. High pressure cleaning (**Fig. 3**) is used mainly where there is a need for removal of thick layer of impurities and grease with the requirements for thorough degreasing without high surface tension.



Fig. 3 High pressure degreasing[6]



The method is based on the rinse with high pressure water stream or the solution that is able to partially dissolve the grease. The fast stream insures the removal of the majority of the grease and the dirt layer. Sometimes it is used as the first step in thorough degreasing where the high pressure solution stream removes the main part of contamination and the fine grease is removed in the bath using the appropriate solution.[3]

### Degreasing using the steam

Steam is natural, non toxic and extremely effective cleaning medium. Most of the time use of chemicals with the steam is not necessary, but this option is not excluded. Simultaneous effect of hot steam, pressure and mechanical activity of customized brush is able to effectively remove grease in solid or liquid form. The main advantage is that it does not damage the cleaned surface (**Fig. 4**). It is possible to combine this method with degreasing mediums where there is the consecutive rinse and drying necessary.[3]



Fig. 4 Steam degreasing[7]

### Measuring of surface tension

The most applicable and cost effective system of measuring the intensity of the surface degreasing is the ink test, which is able to measure the surface tension in a very short time (**Fig. 5**). Surface tension is one of the deciding criteria for adhesion of the printing ink, glues, paints, varnishes, etc. on plastic or metal surface. Surface tension is measured in mN/m (millinewton per meter - actual valid measuring unit) or in dyn/cm (dyn per centimeter- old measuring unit, same value). Regardless of some exceptions the higher the surface tension the better adhesion to the surface.[1]

The low surface tension depends on material specifications. For example many plastics have very low surface tension and because of that they have to be chemically or physically treated -





conditioned to increase the adhesion. On the other hand the reason for low surface tension could be the surface contamination ( grease, oil, finger prints ), most likely in case of metals. Value of 38mN/m is an universal limit. If the surface tension is below this value the adhesion will be poor. If it is above this value the adhesion should be good or at least satisfactory. Anyway it is recommended to check the surface tension for good adhesion in every application.[1]

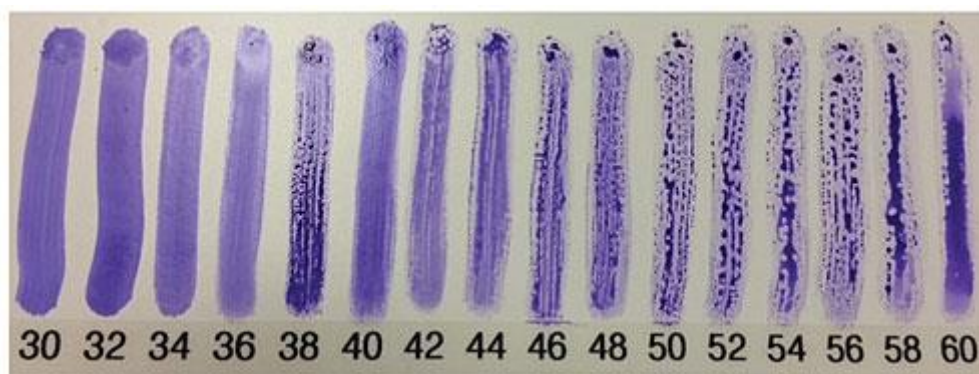


Fig. 5 Surface tension measurement by ink[8]

## Conclusion

Degreasing process is an important process that ensures the quality of the adhesion of the consecutive layer and prevents its premature sloughing. It is always important to think what we need to degrease and to what degree we need to degrease it. Based on conclusions we can choose the method of degreasing that corresponds with the chosen application and is also cost effective.

**Acknowledgments:** The authors would like to thank the KEGA grant agency for supporting research work the project KEGA: 004TUKE-4/2017

## References

- [1] Williams D., Guide to Cleaner Technologies: Cleaning and Degreasing Process Changes, 1994, DIANE Publishing, ISBN 0788114514
- [2] Solverchem company and author, Industrial detergent formulations encyclopedia, Solverchem publications 780 pages, 2015 , ISBN : 978 – 0292 – 1 – 6
- [3] Solverchem company and author, Detergent formulations encyclopedia, Solverchem publications 768 pages, 2016 , ISBN : 978 - 9944 - 0292 - 9 - 2
- [4] <<http://www.mntap.umn.edu/focusareas/air/projects/degreasing/>>.
- [5] <[http://www.alibaba.com/product-detail/Ultrasonic-Cleaner-Industry-engine-carbon-Degreasing\\_60682906855.html/](http://www.alibaba.com/product-detail/Ultrasonic-Cleaner-Industry-engine-carbon-Degreasing_60682906855.html/)>.
- [6] <<http://www.indiamart.com/proddetail/degreasing-chemicals-9438601697.html>>.
- [7] <<http://reaindia.net/industrial-steam-degreasing/>>.
- [8] <[http://www.uvebtech.com/stories/121015/trends-uv-coatings-digital-era.shtml#.W\\_uuUadKhaQ](http://www.uvebtech.com/stories/121015/trends-uv-coatings-digital-era.shtml#.W_uuUadKhaQ)>.



**Contact address**

(1.) prof. Ing. Anton Panda, PhD.

Technical university in Košice, Faculty of manufacturing technologies with the seat  
in Prešov, Štúrova 31, 080 01 Prešov, Slovakia, e-mail: anton.panda@tuke.sk

(2.) Ing. Lukáš Androvič

FTE automotive Slovakia s.r.o., Royová 43, 080 05 Prešov, Slovakia,  
e-mail: lukas.androvic@gmail.sk