

Paolo Nanetti

Coatings from A to Z

**A concise compilation of technical terms
2nd revised edition**

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Contents

Foreword	8
Terms from A to Z.....	10
Register: English to German terms	216
Register: German to English terms	243
Author.....	271



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Foreword

This compact technical lexicon is meant as an easy to use aid, made available to all interested people in need of a quick and concise source of information about single headwords of the coating technology.

It neither presupposes special coating knowledge nor fundamental chemistry cognitions. Nevertheless, as a compact reference book it is suitable to recall latent coating knowledge, for example what has been acquired in seminars and informative conferences or other educational meetings.

Its use is also recommended where knowledge gaps have to be filled quickly and selectively, for example at customer meetings, trade events, and professional presentations.

For readers with a technical education in coatings, this book can also be helpful as a compact and easy to carry information source, when it may be necessary to have a quick overview of the headwords from different sub-fields of the coating technology and to link single terms so that they contribute to a fuller understanding of the field.

In order to improve the general comprehension of this lexicon, chemical formulas and complex scientific explanations have been deliberately avoided. To further increase its practical usefulness for the reader, the lexicon is enriched with many examples of technical applications and practical implications, as well as helped by the creation of cross references to similar terms.

Finally, attached to this book is a register of all German terms with their corresponding English terms and vice versa, in order to facilitate its use as a means for technical translations from one language to the other. The most efficient use is if the reader also has available the German version "Lack von A bis Z".

I would like to express my deepest gratitude to Professor Thomas Brock of the University of Applied Sciences Niederrhein at Krefeld/

Germany for the technical assistance he has lent in the review of the text and for his suggestions concerning the compilation of the text headings. Finally, a special thank goes to my sister Raffaella Nanetti-Leonardi, who has been in the United States for over thirty years and is a professor of urban planning at the University of Illinois at Chicago. Her help has been critical for the correction and optimisation of the English text.

I wish the readers much satisfaction in their use of this book, together with a bit of fun as they nurture their curiosity with information on the fascinating world of coatings and paints.

Paolo Nanetti

Zülpich/Germany, February 2016



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A

abrasion resistance: Important technological property of coatings, which are subject to friction wear. This concerns in the first place floor paints, road line paints, under-sealing coatings, but also wood enamels and interior paints.

accelerators: Additives, which are able to accelerate definite chemical crosslinking reactions and therefore to shorten the hardening times. As examples may be mentioned: driers for oxidative drying (→ *driers*) and cobalt octoate for unsaturated polyesters.

acceptance test: Check of raw materials, delivered from suppliers, before their employment in the coating production. The goal of acceptance tests is to warrant the compliance with defined technical values. To control costs, the emphasis previously placed on acceptance tests has been greatly reduced. Nowadays coating companies rely more and more on the test reports of the raw material suppliers.

achromatic colour: → *colour, achromatic*

acid curing: It is the principle of an acid-catalysed condensation reaction, which can take place with all types of resins containing methylol-groups, formed by a reaction with formaldehyde (→ *amino resins* and *phenolic resins*). The advantage of the acid-catalysis is that the reaction takes place at room temperature, thus without stoving. This is important for bulky machine-casings and other industrial devices, and for parquet floors wood boards as well. Theoretically, all of the so called mineral acids (sulphuric, hydrochloric, nitric acid etc.) may be employed as catalysts. However, if iron corrosion is expected, the passivating phosphoric acid or the mild paratoluene-sulphonic acid are mostly used.

acid curing coating: → *acid curing*

acid resistance: Property required of coating systems as well as of their components (for example pigments), if they are exposed to substances which react like acids, when they are used. This property is particularly important in the case of highly chemical resistant coating materials, expressly produced for employment in the chemical sector, or in the interior can-coating (→ *gold coatings*) sector, but also in coatings which are exposed to polluted atmosphere (acid rain) during weathering.

acids: Strictly speaking they are chemical compounds, which in a solution, due to a protolysis reaction with the medium, separate positively charged hydrogen ions (protons). They represent the counterpart of the → *bases* and can be neutralised by the latter. In the coating technology the acids play a multiple role, because on the one hand they are important source materials for the production of binders (phthalic acid, maleic acid, different fatty acids, acrylic and methacrylic acid), while on the other hand they are employed as catalysts for the → *acid curing*. Further important properties of the acids are their function as passivating and reactive components in one- and two-component primers (→ *primers*) and their use as neutralisation agents in cathodic electrodeposition coatings (→ *electrodeposition coating, cathodic*).

acid value: Important chemical value, which is used above all in the polyester synthesis or in the quality control of polyesters (→ *polyester resins*). It expresses how many milligram of potassium hydroxide are needed, in order to neutralise one gram of resin. The evaluation takes place by means of a titration, with phenolphthalein as indicator. The acid value indirectly gives evidence of the free acid groups which are already present in the resin (→ *carboxyl group*) and, therefore, also of the structure and the reactivity of the resin.

acrylic resins: Versatile group of binding agents with highest performance relative to light and weather resistance. Above all, acrylic resins play an indispensable part when only the smallest possible colour changes can be accepted, and also after very long periods of weathering and influence of ultraviolet rays. Acrylic resins are produced by polymerisation of derivatives of acrylic or methacrylic acid (→ *monomers*). Depending on the chemical structure of the involved monomers, acrylic resins can be employed for physical drying, for cross-linking with isocyanates in two-pack systems or for baking enamels, and additionally for ultraviolet curing lacquers. The main fields of application are automotive coatings and vehicle refinishing, aircraft and commercial vehicle coatings, high performance house paints and synthetic material plasters.

addition polymerisation: Chemical reaction which underlies the curing of two-pack coating systems (for example, isocyanate-based enamels). During the reaction a stepwise cross-linking of both reactants takes place without separation of secondary products. By the progression of the chemical crosslinking, with the exception of two-pack water-borne coatings, the solidification of the coating material also increases (→ *pot life*). After termination of the reaction the hardened coating film is very resistant and not soluble any more.

additive: Auxiliary substance, component of coating materials, which is added to the main ingredients of paint formulations only in little quantities, mostly between 0.1 % and 3 %. The task of the additive is to influence, in a very specific and selective way, some special coating properties. As additives have a very high efficiency, they must be dosed carefully to prevent negative appearances. To make their exact dosing easier, additives are used in the form of highly diluted solutions or pastes.

additive colour mixture: Method to generate colours by mixing coloured lights. What the human eye perceives as a white light, is in fact a mixture of coloured spectral lights, whose colour depends on the respective wavelength of the radiation. One can decompose a standardised white light in three likewise standardised basic colours: violet-blue, green and orange-red. If one mixes all three basic colours, in the form of lights with the same intensity, a white light will be generated. If one mixes only two of them, a mixed light will be obtained, whose colour will be brighter than that of the single original components; for example from green and orange-red one will get a brighter yellow, or from violet-blue and green a brighter blue-green. The importance of the additive colour mixture for the coating sector is limited, being practically restricted to the functioning of the pearlescent pigments. On the contrary, the mixture plays a very important part in the lighting and television technique.

adhesion: Interaction of intermolecular forces of attraction, mostly physical ones, between different substances. These forces are responsible, among other things, for the adhesive strength of adhesives and coatings on substrates.

adhesion primer: → *primer*

adhesion tests: The most commonly used measuring method, to determine the adhesive strength in the coating technology, is by far the → *cross-hatch adhesion test*, because it can be carried out without complexity and it provides significant results. The pull-off test is used very infrequently. In regard to the pull-off test, the adhesive strength is measured by means of a disc bonded to the surface and of a tensile testing machine.

adhesive strength: Prime property of all coating materials and systems. Without sufficient adhesive strength, in the long run the other required coating properties cannot be performed. The adhesive strength is based on different physical attractive forces of electrical nature like Van der Waals forces, dipole forces and hydrogen bridge bonds (→ *adhesion*), which act between two substances, for example primer and substrate

or topcoat and filler, subject to their polarity. Basic requirements for an optimal adhesive strength are the accurate pre-treatment (degreasing, removing of silicone remains, sanding etc.) as well as the sufficient wetting of the substrate.

aeration: → *ventilation*

aerosol: Fine dispersed liquid droplets in a gas, generally air. During the spray application of liquid coating materials, aerosols are artificially generated by atomisation, which provides an uniform distribution of the coating droplets all over the object surface. Coating aerosols must not be inhaled by the users, because they can cause health damage.

aerosol lacquers: Coatings, which are formulated for application by means of spray cans. The total compatibility of the coating material with the liquid propellant agent contained in the can (in the past fluorinated/chlorinated hydrocarbons, but today in Europe and America only propane/butane mixtures or dimethyl ether), is of major importance. Another important requirement is that the pigments should not form hard cake sediments even after long storage periods, in spite of the low viscosity in the aerosol can. They have to be stirred up completely by simple shaking of the can and by means of the metal balls contained in the can, to permit a perfect retrieving of the desired colour. While aerosol lacquers dry very quickly, nevertheless they have to show good levelling. If they are destined to application in automotive refinish, they have to be suitable for polishing, even after a short drying. The most important film formers for such coating systems are nitrocellulose and physically drying acrylic resins.

after-treatment: In the coating technology, this term refers essentially to processes aimed at improving some properties of pigments and fillers (extenders). Thus, for example, all titanium dioxides for the coating industry are after-treated to provide a reduction of their tendency to chalking. Difficult to disperse channel carbon blacks are after-treated by oxidation of their surface, in order to get better wetting properties. An after-treatment variant, which can be found often in the extender-sector, is the coating with silanes. In this case, the particle surface is equipped with water repellent groups, in order to improve the → *barrier-effect* in corrosion protection systems.

agglomerates: Coarse particles of pigment, which develop by a disorderly association of primary particles and → *aggregates*. The agglomeration takes mainly place by the drying of the pigment, during its production process, but it occurs also as flocculation, during the storage and the processing of coatings. This depends on the effects of the forces of

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COATINGS FROM A – Z

The Mission: A compact lexicon of all the key technical terms encountered in the coatings field – explained concisely and clearly, with the bare minimum of chemical formulae and complex scientific details. An easy-to-use reference for anyone confronted with technical coatings terms.

The Audience: Purchasers, career changers, trainees and production employees who have no previous training in coatings and are keen to acquire a basic knowledge of the technical terms. Readers with a formal technical background will welcome it as a compact ready-reference.

The Value: This fully revised 2nd edition contains all the key technical terms employed in coatings technology, presented in a convenient, highly accessible format. It is packed full with examples of technical applications and practical implications, along with cross-references to similar terms.

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