Anodizing

Anodizing is one of the most widely used methods for treating the surface of aluminum workpieces. In this surface treatment, an anodizing process is used in which the surface of the component is specifically oxidized electrolytically—the top layer converts into a stable oxide compound Al_2O_3. Changing the process parameters allows the layer thickness to be varied between 5 and 25 µm and allows organic, inorganic, or electrolytic coloration.

The surface treatment takes place in an electrolytic tank, whereby the workpiece acts as the anode and the sulfur or oxalic acid filing is the cathode. Usually direct current is used, which creates a weak flow of current between the two electrodes. The hydrogen ions created in this process stimulate electrochemical corrosion on the aluminum surface, during which released atomic oxygen reacts with the metallic aluminum to form a hard oxide layer.

Anodizing is mainly used to give aluminum workpieces better corrosion resistance. Introduction of dyes in the Al_2O_3 layer also allows anodizing to permanently color code components or visually enhance them – for example, by means of a red color.

Black oxide coating

Black-bronzed parts are only minimally protected against corrosion. The process is therefore, usually used to improve storage stability or for decorative reasons.

When the workpieces are placed in the hot black oxide solution, a chemical reaction creates a mixed oxide layer consisting of FeO and Fe_2O_3 with a maximum thickness of 1.5 µm. The dimensional accuracy is preserved. The conversion layer is heat resistant up to about 300°C and is resistant to abrasion and bending, although it is too porous to provide adequate protection against corrosion. This protection can be achieved through additional coatings for which the black-oxide layer acts as a primer. The process is standardized according to DIN 50938.

Chrome-plating

Chromium layers with thicknesses between 8 and 10 µm are used for decorative purposes and are available as glossy or matte chrome-plating from Ganter.

The process is galvanic process. Chromium ions are supplied from an aqueous solution with a chromic acid base.

Usually a combination of layers are necessary, whereby which the chromium always forms the top layer. For example, Ganter uses two-layer chrome-plating with nickel as the first layer and chromium as the top layer. The three-layer process is also used. Here the first layer is copper, the second nickel, and the final layer is chromium.

Chrome-plating is a comparably cost-intensive process that places high demands on occupational safety and environmental protection due to the use of chromium(VI)-based electrolytes. Alternative electrolytes based on non-toxic chromium(III) are still in the testing phase.

Electropolishing	Galvanizing	Nano-passivation
This electrochemical process reduces surface roughness and removes impurities, microfissures, and microstructural defects in stainless steel parts. The workpiece is placed into an immersion bath containing material-specific electrolytes and forms the anode from which a thin metallic layer is removed after direct current is applied. Electropolishing operates on the micro-scale and removes rough peaks, while generating increased abrasion at the edges, which also makes electropolishing ideal for fine deburring. The process is gentle on the structure since there is neither thermal nor mechanical stress. In addition to decorative applications, electropolished elements are used, for example, in the chemistry and food industry, in container construction, or in medical technology.	This general term stands for various processes for the application of pure zinc layers to steel. In all cases, the objective is to protect the substrate against corrosion for as long as possible. The galvanic zinc-coating most commonly used by Ganter uses a bath in which an electrolyte connects the workpiece which acts as the cathode to an anode made of pure zinc. Depending on process parameters, the layer thicknesses which are deposited in this way range from 2.5 to a maximum of 25 µm. The process, which is standardized according to DIN 50979, is mainly suitable for corrosion protection of small parts. The zinc which is present on the surface may also be exposed to corrosion depending on ambient conditions and is therefore subsequently protected by additional passivation to prevent zinc corrosion (white rust). In addition, treatment with suitable chromium(VI)-free solutions creates a chromate layer, which considerably improves the corrosion resistance of the zinc coating. Dyes can also be introduced in this process step.	This process provides exceptionally good corrosion protection with minimal layer thicknesses for die-cast zinc parts. The passivation layer is only 0.3 to 0.5 µm thick and does not affect dimensional accuracy. Ganter, usually uses an anthracite-colored layer. The passivation consists of a chromium(III) layer and an overlying layer consisting of nanoscale SiO_2 particles which have self-healing properties. If the surface becomes damaged down to the metallic substrate, the SiO_2 particles migrate through the potential differences in a mobilized way to the unprotected area to reclose the layer. Nano-passivation can be performed quickly and economically as a spray or immersion process—and is also a good primer for subsequent, further coatings, such as powder coating.

Nickel-plating	Powder coating	Steam oxide coating
This term is a collective term for different processes that are used to apply nickel to metallic substrates. Nickel-plating is divided mainly into galvanic and chemical nickel-plating. With galvanic nickel-plating according to DIN EN ISO 1456, nickel ions are deposited from an electrolyte by the application of an electrical voltage. The layer created in this way appears silvery with a light yellow shade and is resistant to water and diluted acids and bases, but does not protect against tarnishing. Corrosion protection is also only provided to a limited extent, as the layers, which are less than 25 µm thick, are usually porous and are therefore susceptible to pitting. Multi-layer systems with chromium as the top layer are more resistant in this respect. Chemical nickel-plating, on the other hand, is not an electrochemical process. It is a reduction reaction of the surface of the part in the electrolyte bath, in which a uniform, non-porous nickel layer is formed. The end result provides very good protection against corrosive media, good abrasion resistance, and high hardness – including for parts with complex geometries with interior surfaces. The nickel layer created in this way can be soldered and is non-ferromagnetic.	Powder coating, also known as plastic coating, usually refers to the electrostatic process variant. The powder, consisting of pigmented thermoplastic polymer or reactive binding agents made of epoxy resin, polyester resin, or acrylic resin, is applied to the workpiece. Inside the spray nozzle, the powder accumulates a negative electrostatic charge, flows along the field lines to the grounded workpiece, and also reaches the rear of the workpiece. The electrostatic charge reduces overspray and ensures adhesion of the powder up to its thermal fusion. The actual closed and homogeneous layer, with a thickness in the range from 100 to 200 µm, is not created until this step in the process. Depending on powder type, the layers are highly resilient, weatherproof, and corrosion-resistant. They also can be produced in a wide variety of colors. Powder coating is very popular due to the ease of automation of the process and its economic feasibility.	This process is used for the post-treatment of hardened sintered parts for which black oxide coating using a saline solution cannot be used. With steam oxidation, the sintered part is treated with water vapor at temperatures in excess of 350 °C. The result is a thin, almost black homogeneous oxide layer of about 1 µm. Steam oxide coating only increases corrosion resistance to a small extent.