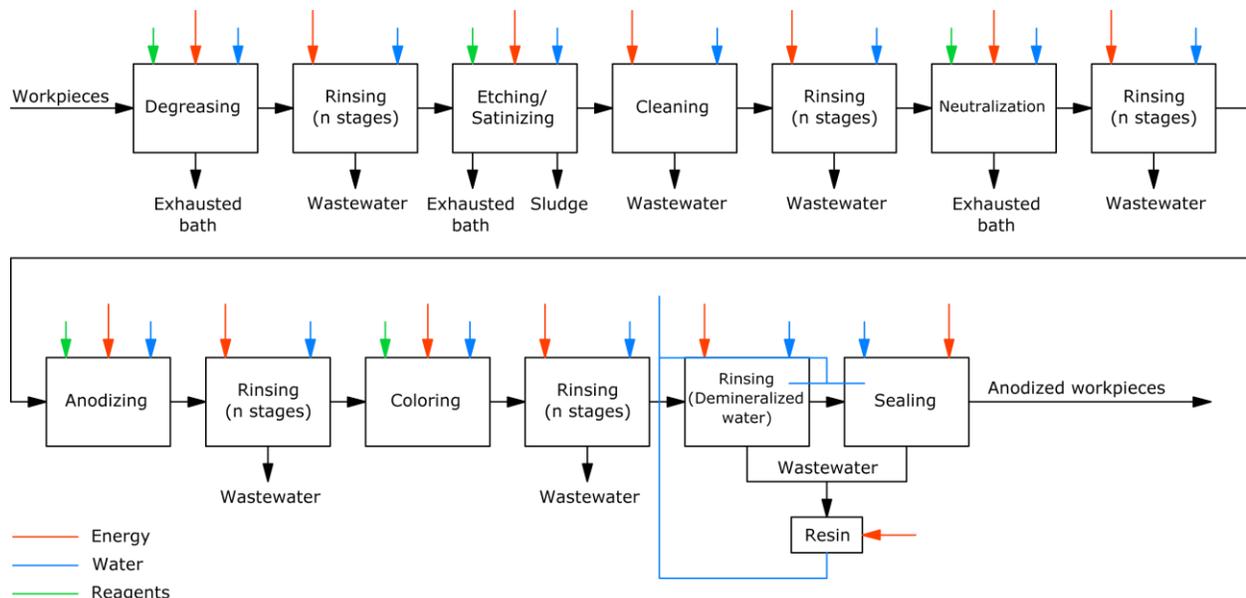


Galvanic Industry– Metal Surface Treatment Aluminium etching/anodizing for analysis of Acids, Bases and Aluminium

Aluminium is the most abundant element and is a very reactive base metal. It has favourable qualities for industrial applications due to its low density, high electrical and thermal conductivities and high corrosion resistance. Aluminium metal oxidizes spontaneously when exposed to atmospheric oxygen, water or other oxidants forming an aluminium oxide skin by passivation (natural oxidation process). This natural oxide layer protects the underlying aluminium against corrosion but with some limitations. In order to enhance corrosion resistance and surface hardness Aluminium is further treated by an anodizing process. Anodizing is an electrochemical treatment that increases the thickness of the aluminium oxide layer onto the metal surface that depends on pre-treatment, a core treatment and finishing steps to complete the cycle. After the initial degreasing step to remove dirt, oil and lubricants the workpiece undergoes an alkaline etching step to remove the natural oxide layer in order to present a virgin surface for anodizing. To avoid process variations and to obtain the expected result and finish the correct dissolved aluminium/free soda ratio is critical at all times in the bath. If this ratio falls out of prescribed limits hydrolysis of sodium aluminate to aluminium trihydroxide occurs forming a rocky precipitate that covers the components and inhibits anodizing. As sodium hydroxide is consumed the etching rate slows down resulting in variations in the final product appearance. Therefore On-line performance monitoring and control for both base and dissolved aluminium concentrations is essential to guarantee higher yields and throughput while minimising defects and reprocessing.

The anodizing bath is typically made up of a sulfuric acid electrolyte. During the anodizing process the workpiece is made anodic so that the metal reacts with the oxygen of the anion and a layer of oxide forms on the surface. Aluminium is partially dissolved and has to be kept low in concentration as not to have a negative effect on the final surface appearance while a high concentration will lead to higher electrical resistance and costs. Sulfuric acid is consumed due to a degree of product drag out and must be replenished optimally to reduce run costs while still providing maximum quality.



Typical anodizing line



Application: On-Line monitoring of the alkaline, acid and aluminium by titration with Process Analyzers ADI 2045TI and ADI 2016 depending on single or multi parameter needs.

Typical Range:

<u>Etching:</u>	Alkalinity (NaOH):	50- 120 g/l
	Aluminium:	70 – 150 g/l
<u>Anodizing:</u>	Free Acid:	Can vary from low ranges 0,1 ... 2 g/L up to 300 g/L
	Aluminium:	1 – 10 g/l

Remarks: Aluminium metal is also an ideal material for other surface treatment applications. It can be applied in acid pickling processes to clean the surface and to assure a complete passivation. A pickling process is also used to prepare the aluminium for applying a conversion coating as a protective surface layer. Depending on the application and aluminium alloys used acid pickling can use nitric acid, a combination of nitric hydrofluoric acid and phosphoric acids as working solutions. Metrohm Applikon On-Line Process Analysers are also applied for performance monitoring and control of these pickling baths.