

Adaptation of a new energy- and time-saving hard anodising process for different Al-alloys and tests in selected European industrial applications

Acronym: PulsCoat®System

1. Aim

FISCHER OBERFLÄCHENTECHNIK GmbH has developed a special technology to coat aluminium and to save up to 70 % of the energy compared with conventional processes. The preceding development of the basic technology was funded by the DBU Deutsche Bundesumweltstiftung. The EU-project aimed to make the process available for a wide range of applications, optimised with respect to

- heavy duty applications (e.g. aerospace parts, automotive and new technologies)
- low energy demand for bath cooling (e.g. application in hot countries)
- general industrial purposes.

The project started in January 2003.



Photo 1 : The anodising baths venue (left) and test parts, just coated

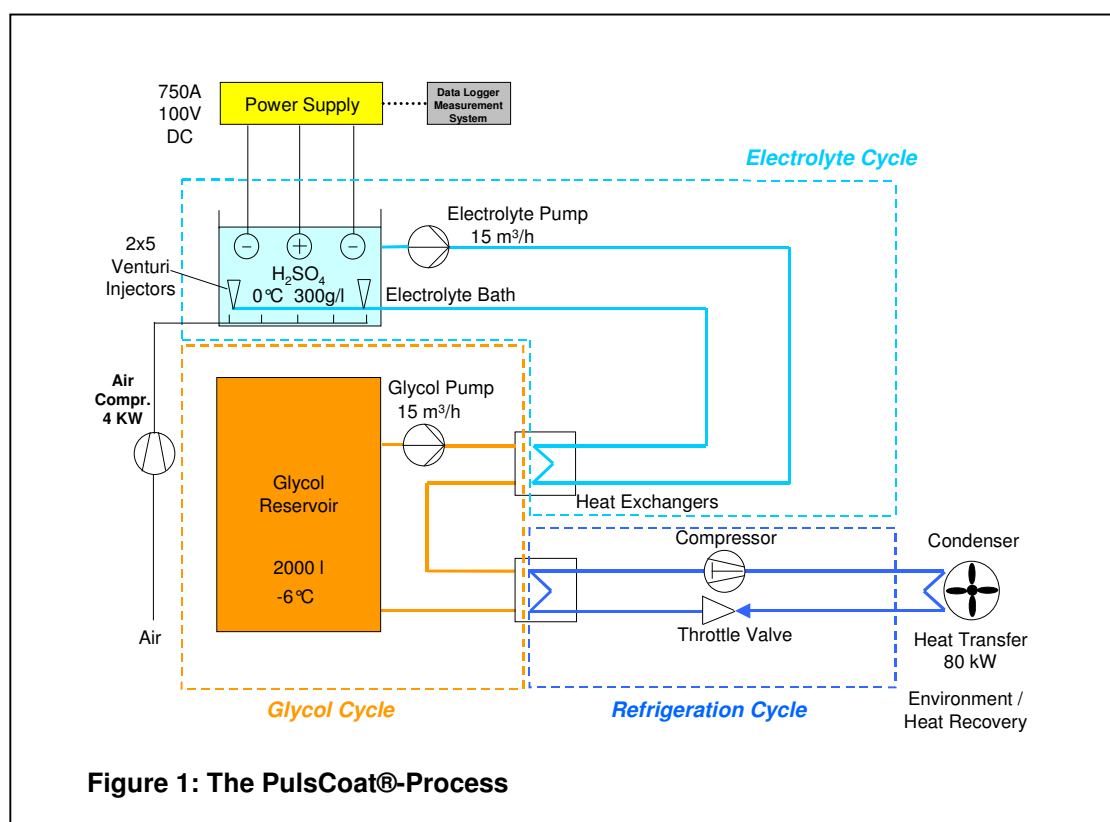
2. Introduction

In aluminium production, only a small amount of coated aluminium is produced worldwide because the coating process is very energy intensive and therefore expensive. In addition, the coating of high tensile aluminium is problematical. Traditionally this market segment is covered by SMEs which may have good opportunity to increase the existing markets by adopting this new material in production processes and product design. The aim was to develop, use and test a new hard anodised coating process which reduces energy consumption by up to 70 % compared to current practises and allows coating of high-solid aluminium alloys. Long-term testing and quality control was included. This opens new market segments esp. in aeronautical, automotive, marine industries and in the production of multi-use components in a wide range of domestic and industrial applications. An essential aspect was the production in different European countries.

3. Technical Description

Figure 1 shows a diagram of the PulsCoat® Process, as it is run in the facility in Witten at Fischer Oberflächentechnik GmbH. This diagram gives a description of the whole system. This production line is only one in a line of several different ones. So there is the possibility to run measurement activities on this PulsCoat® production line in comparison to conventional production lines, where the anodizing process is run with traditional techniques.

Central part of the system for coating is the bath with the electrolyte. The specimen are duely rinsed by a venturi jet array which is supplied with cooled electrolyte. The flow of the electrolyte was thoroughly investigated to avoid fluctuations of the layer thickness, which is a major quality criterion of the coating. A specially designed power supply allows to apply numerous forms of current in order to investigate the influence onto the coatings. Additional parameters to be adjusted in the experimental series were the different temperatures as well as different electrolytes.



4. Performance of the PulsCoat®-Process

The PulsCoat® multi-parameter optimisation results in an unique innovative technology which can be applied in a wide range of applications: heavy duty applications in the automotive sector, aircraft and aeronautic industry as well as in the packaging industry is the cutting edge of the new technology; both customer applications and the use in hot countries to produce high quality coatings on different materials are the merits of the PulsCoat®-Process on the other side.

Applying a new developed Reversed-Pulse-Technology (RPT) – superposition of the DC by an AC current – the voltage at the bath electrodes could be considerably reduced by approx. 60 % compared with standard processes. With the help of a new power supply the superposition of currents corresponds with the grey area in Figure 2.

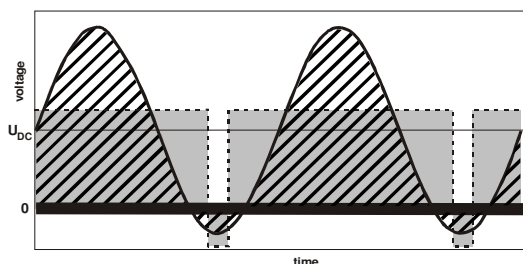


Figure 2:
Superposition of DC (U_{DC}) by an AC current; the new power supply combined these currents to the gray course of current

Applying the advanced power supply technology a wide range of Al-alloys was coated which can not be anodised in conventional eloxal baths. These alloys were: Al-52, Al-239, Al-233, Al-226, Al-230, Al-230D and Al-2017. All specimen were tested regarding the thickness of the coating, microhardness, resistance to abrasion, wear resistance and other criteria which are relevant in practice. It turned out that parts for rallye sport cars made of aluminium and coated with the new process had even a better performance in terms of wear resistance, hardness, production handling and long term behavior than standard steel parts.



Photo 2: Four excellent examples for an innovative substitution of steel materials for heavy duty applications and for consumer industry: a holder for tools in furniture industry; chassis lift for a Lamborghini sports car; clutch basket for motocross cycles; part for a hunting weapon (from left)

The process was optimised within three categories: heavy-duty applications, operation in hot countries and general industrial applications. Thus the benefit of using light materials will come available for almost all industrial sectors.

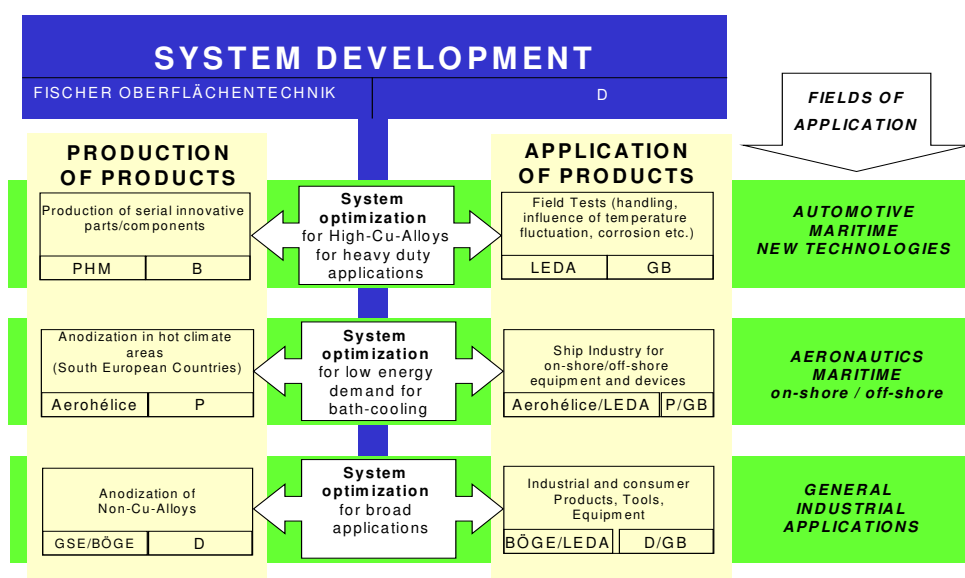


Figure 3: Relation Between System-Developer, Producers And Applicators

5. Economic Performance

Three aspects are considered to estimate the economic impacts.

First: in production processes such as cutting techniques the easy handling and low energy consumption is an economic advantage together with the possibility to use light materials instead of steel, which was not possible before. The energy reduction of coating is a further considerable advantage especially for SMEs engaged in surface treatment. Saving: approx. 900'000'000 kWh per 10 years.

Second: the reduced weight will save energy in the life-cycle of the products. Under conservative assumptions a energy reduction potential of 90'000'000'000 litres of fuel in ten years (lifecycle of a car) is realistic.

Third: Aluminium can easily be recycled and thus contributes to energy saving even after the life-cycle is expired.

An addition aspect which is not considered in the project regarding the economic impacts is the reduction of CO₂ emission of approx. 220'000'000 tons in 10 years, i.e. within the life-cycle of a car.

6. Project Identifiers

Project:	NNE5-2001-402
Owner:	Fischer Oberflächentechnik GmbH Wullener Feld 15A 58454 Witten Germany
Contractor:	FISCHER Oberflächentechnik GmbH Wullener Feld 15A 58454 Witten Germany Tel: +49-2302-282550 Fax: +49-2302-2825510
Technology:	Aluminium Coating
Total Cost:	1,825,687 EUR
EC Support:	995,796 EUR