ALUMINIUM 2020: Focus on megatrends

The world of aluminium is already now looking ahead to its leading trade fair next year with great anticipation. Because despite global rises in demand the industry faces a variety of challenges – from globalisation and new mobility to digitalisation, recycling and sustainability themes. From 6 to 8 October 2020 ALUMINIUM in Düsseldorf will showcase the opportunity and growth perspective for the industry. Approval from the sector is huge.

Already one year to the start of the trade fair 90% of the 80,000 square metres of exhibition space are booked up – a clear indication of the dynamism in the aluminium industry. In total, the organiser Reed Exhibitions brings together more than 1,000 exhibitors and 27,000 visitors from over 120 nations.

The aluminium industry sends out important impulses – for lightweight construction and material innovations in automotive production, aviation, mechanical engineering, construction, boat building, in packaging as well as in the sports and leisure sectors. In six exhibition halls global players, specialists and young, innovative enterprises will showcase the performance spectrum of the material and the whole cross-section of the industry – from aluminium production, finishing machines and equipment to finished products and recycling.

ALUMINIUM is the global marketplace for its industry. The investment volume that visitors brought to the previous ALUMINIUM amounted to over EUR 14 billion. Almost one in two trade fair visitors comes to Düsseldorf with concrete sourcing intentions. No wonder this trade fair for the aluminium industry is the most important event worldwide. Some two thirds of the exhibitors and visitors to the trade fair come from abroad.

The trade fair also shows how well connected the value chain is across national borders. Alongside the mega trends New Mobility and Digitalisation, the ALUMINIUM trade fair 2020 will place special focus on resource efficiency and sustainability because business developments will in future also depend on companies’ resource productivity.

By occupying a themed area on aluminium recycling the trade fair makes it clear how recycling continues to gain importance as a source of raw material and contribution to resource efficiency. Even today aluminium scrap is considered one of the most economically valuable secondary raw material and, hence, a key factor in the aluminium value chain.

The situation is similar for sustainable aluminium production and processing: Environmental Engineering has long since demonstrated the advances made by the aluminium industry in its production chain in terms of sustainability and the contribution to environmental protection.
Adhesive processes: Pretreatment of aluminum lights with atmospheric pressure plasma

Groundbreaking decision: Adhesion without primers

Just a few years ago, lighting manufacturer Waldmann based in Swabia in Southern Germany decided to radically change his pretreatment process prior to bonding. Instead of wet chemicals, atmospheric pressure plasma achieves the high level of adhesion required for the thousands of aluminum lighting housings produced each year.

One of the company’s specialist areas is the production of industrial lighting, especially LED surface-mounted machine lighting. Since these lights are designed to illuminate machine interiors, their housings and covers are frequently exposed to high mechanical loads (e.g. flying chips) and in particular, to chemical substances such as cooling lubricants and oil (Fig. 1). None of this should compromise the tightness of these luminaires, which is why the requirements for the bonded joints of the housing are extremely high. An especially effective pretreatment of the material surface is inevitably required to produce a strong, long-term stable bond.

In search of an alternative

The use of wet-chemical substances is still one of the most widely used pretreatment methods in the industry. It was no different at Waldmann. For years, an employee working in a separate pretreatment booth cleaned the adhesive surfaces by hand using a cotton cloth soaked in solvents. He then inserted the parts in an automatic priming station, where they were treated first with an activator and then again with a chemical adhesion promoter using a felt applicator. The fourth step was to remove the parts and air-dry them, then finally transport them by trolley a distance of ten meters to the bonding station.

Waldmann had been looking for an alternative to this method for a very long time. Not only was it harmful to the environment; the use of chemically reactive substances was associated with substantial additional costs for cleaning, materials and disposal. Other factors such as open times, shelf life and storage stability of the primer, as well as cleanliness of the rise cables in the station also had to be continuously monitored. The activator, adhesion promoter, spare parts, service and maintenance of the primer station alone incurred annual costs running into five figures. It was clear that the entire wet-chemical process should give way to a more efficient, environmentally friendly method.

Plasma instead of solvents

Waldmann’s rethinking of the pretreatment of its luminare housings was put into concrete terms by a seminar held by the adhesive manufacturer Rampf, which, among other topics, dealt with the environmentally friendly pretreatment of material surfaces using atmospheric pressure plasma (APD plasma). More precisely, the Openair-Plasma technology (Fig. 2) from Plasmatreat.

The process is known for its use of plasma lasers. The environmentally friendly technology used worldwide requires only compressed air as process gas and electrical energy for the operation of the nozzles. As a result, VOC emissions (volatile organic compounds) are avoided during production from the outset. The highly effective process is used mainly on materials such as plastics, metals, glass and ceramics.

The plasma nozzles perform three operations in a single step lasting only a matter of seconds: Dry microfine cleaning, electrostatic discharging and simultaneous activation of the surface. The result is homogeneous wetting of the material surface and long-term stable adhesion of the adhesive bond or coating, even under challenging load conditions. During cleaning, the high energy level of the AP plasma fragments the structure of organic substances on the surface of the material and removes unwanted contamination even from sensitive surfaces. Furthermore, the very high output rate of the plasma ensures that particles loosely adhering to the surface are removed.

Surface activation means modifying a surface at a molecular level in order to optimize adhesive characteristics for downstream processes such as bonding or coating, for example.

Plasma nozzles are area-selective, in other words the plasma is applied with pinpoint precision only where pretreatment is required. Long-term stable adhesion is conditional on the plasma and the new adhesive used. The Openair-Plasma technology (Fig. 3) from Plasmatreat. Safe for electronic components

Waldmann was particularly impressed by the high process reliability and accurate reproducibility of the environmentally friendly plasma process, as well as its speed and efficiency. But they still had some reservations: Would the electrical potential generated in the plasma beam damage the sensitive LED components? Since the electronics are pre-installed in some of Waldmann’s lighting housings, they feared that the electrical potential present in the plasma could cause short-circuits, leading to the destruction of electronic components. Plasmatreat confirmed that although these concerns were justified in principle, the Openair-Plasma technology had a special feature: In recent years the company had developed special nozzle heads which discharged the electrical potential to such an extent that the plasma impinging on the material surface was virtually potential-free. This now made it possible to pretreat even highly sensitive SMD assemblies and other delicate electronic components without damaging them.

During the 18-month test phase, Waldmann explored the uppermost limits of what an adhesive bond subsequently exposed to challenging chemical load conditions would have to endure. The microfine cleaning and activation power of the plasma was easy to demonstrate: Test ink measurements carried out before plasma treatment revealed surface tensions of < 44 dyne for aluminum, 36 dyne for glass and 40 dyne for plastic. After plasma activation, values ranging from 56 dyne to 72 dyne were measured on...
Heat treatment with great temperature precision and process reproducibility

Hofmann Wärmetechnik from Linz in Upper Austria is a manufacturer of heat treatment equipment for the aviation and automobile industries. The company has existed since 1946 and has developed from a supplier of small furnaces to become a pure manufacturer of special equipment. The plants are continually developed further, with particular attention given to user-friendliness and low maintenance costs. The customer’s wishes are strongly taken into account in the plant design, programming and visualization. After a test run, the units are designed, programmed, made and assembled in-house.

Hofmann has a wide range of customers from a variety of application sectors, for example classical suppliers such as forging operations and foundries, and up to OEMs in the aviation and automobile industries. Customers in the aviation sector include for example Airbus, Eurocopter, Pilatus, while in the automotive sector customers include Daimler, Audi and BMW. The Nadcap (National Aerospace and Defense Contractors Accreditation Program) specifications of the AMS 2750c also present plant manufacturers and furnace operators with major challenges. In such customer circles particular attention is paid to the following points:

- Great temperature precision in the furnace and during the cooling phase
- An essential factor relating to heat treatment plant is a detailed knowledge of the batch data.
- In the heat treatment of structural aluminium components the parts being heat treated are usually combined with the charging rack: the plant operator scans the components and the rack and starts the process: The rack is tracked throughout the passage of the batch and the rack number is re-checked at predefined points. The process parameters such as temperature, temperature speeds, pressures, times) are recorded in a data package at every position as the rack travels through the furnace. If the measured parameters are found to be outside the defined tolerances, the rack is classified as ‘bad’ (not in order).
- After the end of the process the rack is scanned once again and its data are linked to the data of the components and stored correspondingly.
- Process reproducibility, regardless of the charging position in the heat treatment rack.
- Short transfer times from the furnace to the air blast or quenching tank.
- Archiving of batch data, tracking and evaluation or documentation.

In addition, large fan outputs are used to transfer the energy evenly and quickly to the charge. At Hofmann, the fan wheels are driven directly via an extended motor shaft, which in turn has the advantage that the energy loss is as low as possible and the fan units can be easily replaced.

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