Fast RTM for Epoxy-based moulded composites: more solutions from Cannon!

The recent introduction of new Cannon technologies for the manufacture of Epoxy-based moulded composites was awarded with numerous positive answers from the market. Cannon have introduced three different impregnation systems based on high pressure technology. A whole range of solutions is now available to respond to different needs and processes. Cannon supplies today the widest set of tools, including dispensing and mixing devices, preformers, presses, moulds, manipulators, ovens and controls.

Cannon launched three years ago their new high-speed RTM technology for Carbon reinforced composites based on Epoxy resins. The new process, called ESTRIM (Epoxy Structural Reaction Injection Moulding) gave the opportunity to the industry to use new, fast reacting Epoxy formulations, developed to comply with the high productivity required by the automotive industry, for their rising number of structural composite parts. Based on a series of integrated products - Carbon reinforcement handling systems, dedicated preformers, high-pressure dosing units for Epoxy, multi-component mixing heads with different distribution methods, moulds, large-size hot press with accurate parallelism control (for part forming), low-tonnage cold press (for part controlled cooling) and relevant handling systems of preforms and moulded parts – the ESTRIM process immediately received a positive response from the market. The possibility to go from a traditional 30-minutes cycle of conventional RTM down to 3 minutes with ESTRIM appealed OEMs and Tier 1 companies. All the major players in the field of automotive composite parts visited during the past 36 months the Cannon R&D laboratory in Italy, either to run moulding tests with their own new materials and moulds or to discuss directly the supply of equipment for their composite research and production departments. The immense exchange of experiences matured during these visits stimulated the development of new methods for distributing the liquid Epoxy resins in the Carbon preforms. In addition to the ESTRIM RTM fast injection technology, Cannon have developed two alternative methods for the impregnation of these more or less flat mats, both to be applied in required by the part’s geometry.

The ESTRIM LL (Liquid Laydown) - the Epoxy formulation is laid over the Carbon mat in “liquid ribbons” of varying width, typically from 40 to 120 mm, perfectly impregnating the reinforcement and limiting the possibility of air inclusions in the moulded part. This technique allows for the production of very large parts, writing uniformly the huge, almost flat preforms that characterize parts such as roofs, engine hoods, fenders and doors. The reactivity of the systems being controllable on a part-to-part basis, this system allows for a comfortable laydown time even for the largest pieces. As in the SL alternative, the formulation does not need to flow through the mould, therefore guaranteeing the most homogeneous distribution of liquid resin in the Carbon reinforcement.

ESTRIM SL (Spray Laydown) - the Epoxy formulation is sprayed directly over the reinforcement, covering each square centimetre of reinforcement precisely, applying the desired amount of liquid resin where it is required by the part’s geometry. This technique allows for the use of viscous formulations, characterised by low fluidity: being directly deposited into the liquid does not need to flow through the fibres, avoiding any distribution problem. A certain degree of part’s three-dimensionality can be approached without problems, since the head can be tilted on a four-axis axis over the vertical sides of a mould during the spraying operation. The use of a Cannon proven airless mixing head significantly reduced the amount of entrapped air, enhancing the transparency: and the mechanical characteristics of the final layer of hardened resin.

The new high-pressure, plunger-plunger dosing unit for the release agent feels the innovative chemical directly in the resin stream just before the head’s injector.

ESTRIM LL, the new Epoxy Liquid Laydown Impregnation system developed by Cannon for a very homogeneous distribution of liquids over Carbon preforms.

The optimization of the above process not only keeps low part-to-part cycle time, but also requires lower compression force, and thus reduced capital investments which in the end leads to lower part cost.

We should not forget the development of new alternatives for the traditional high pressure injection in closed moulds, performed with the original ESTRIM technology. The experiences matured in the past in the field of short-stroke polymerisation processes have allowed for at least two more injection methods:

1. The resin can be injected with a variable output, commanding the operation by reading the internal pressure in the moulds. The signal is sent to the unit’s PLC, that defines the new output value to be applied and command the dosing pumps in real-time, working in closed loop control. The press does not move during the injection.

2. The injection-compression method can be applied, by leaving the mould partially open during the injection (still guaranteeing the tightness of the cavity) and applying the final compression stroke at the end of it. Further developments are announced

Cannon announced at JEC Composite Show 2013 in Paris the three-component dosing method for ESTRIM. The third component, a release agent, is metered at a very low output (few grams per minute) by a separate new plunger-plunger high-pressure dosing unit: the flow of release agent enters in the resin stream immediately before the relevant injector, on the mixing head. Thoroughly blended in with a state mixture, this non-reacting chemical is dosed with extreme precision to the reacting formulation. The hydraulic valve controlling the third component ensures a perfect feeding synchronization of this stream into the resin, avoiding any possible contamination of the mould.

The head performing this operation is an CPC PFL 2.1K, which can be supplied in various configurations: for closed-mould injection, for Spray Laydown (SL) or for Liquid Laydown (LL). Two versions of the Cannon E- System machine are now available: one extremely flexible for laboratories and one very large, featuring a tilting upper plate for manufacturing very large parts, wetting uniformly the huge, almost flat preforms of advanced parts such as roofs, engine hoods, fenders and doors. The reactivity of the systems being controllable on a part-to-part basis, this system allows for a comfortable laydown time even for the largest pieces. As in the SL alternative, the formulation does not need to flow through the mould, therefore guaranteeing the most homogeneous distribution of liquid resin in the Carbon reinforcement.

New tools for customers in Cannon R&D facilities

The search for new solutions and the intense cooperation with the major players involved in this business area need the Cannon management to invest even more resources in this field of activity: in the central R&D laboratory in Canonno Pertusella, near Milan, Italy, near floor space and equipment have been dedicated to the development of Epoxy-based composites. In addition to the just announced high-pressure injection machines, with the three-component dosing method, a new 650 Tons hot press will be installed later this year, allowing for the production of large parts with the customer requirements. Add to this the existing 1,200 Tons hot press that has been extensively used for test plates and small parts. The new clam will speed up the development of proper processing solutions that require a high degree of integration between dosing machine, mixing head, mould and press. Dedicated R&D continues at Cannon, with the fundamental contribution of the interested end users and Raw Materials Suppliers. An intense calendar of trials has already been held to date and numerous customers are always running out! Should you have a real interest in exploiting these resources for a project related with fast Epoxy-based RTM production, please contact Cannon Asia at marketing@afros.it to be put in contact with the relevant team of specialists.

With their available, proven industrial solutions for a vast range of needs, Cannon is today the ideal partner for complex – and also for simple – Epoxy processing projects for the composite industry. Once again, the concept of “One-Stop-Shop” for all the chain of equipment and tools can be the winning move for both parties.

Alberto Bonacina, chief of Cannon Central R&D laboratory for reacting formulations, extracts a moulded Epoxy-based composite material using the ESTRIM LL (Liquid Laydown) technology.
The range of dedicated presses expands: new models are available for fast RTM and light composites.

More than 45 years of experience in presses for composites, delivering all sorts of models up to 3,250 Tons of clamping force and up to 3,500 x 3,500 mm of platens dimension, characterise the Cannon offer to a sector of the plastics industry that is featuring an impressive growth rate. All the most recent processing technologies can be applied using a Cannon press. A unique set of tools is available, to be used with and around these complex machines: moulds, handling systems, dedicated preformers with patented slip-control methods, pre-heating and post-curing ovens, several methods for the impregnation of the reinforcements with various families of reactive chemicals, all the safeties around the working areas and a specific electronic control designed for these operations.

Designed and built to last, the Cannon presses for composites have been used for more than four decades for compression molding of SMC, BMC, GMT resins. Characterized by a four-column construction, they allow for optimum distribution of pressure over the whole mould surface and for flexible approach from the four sides for all manual and automated loading and unloading operations. The availability of a sliding upper platen and a sliding lower platen (the shuttle system), that can also be supplied in a double version, sliding towards both sides of the press for an increased productivity rate of the working island, allow for ergonomic service operations and for the manipulation of the largest moulded parts. Presses with platens up to 3,500 x 3,500 mm dimensions have been manufactured, featuring specific pressures from 10 to 100 bars: the former is mostly used for materials requiring only a containment in the mould during an impregnation phase, while the latter is specific of true compression processes. Cannon customers in this field include all the major European manufacturers of composite parts.

A new, flexible 650 Tons model for Product Development

When the highest dimensional precision is demanded, a short-stroke press can be supplied, featuring a very compact design combined with excellent control of active or passive parallelism during the final clamping stage and fast operating cycle, due to the limited amount of hydraulic oil used in the circuits. A new 650 Tons model has recently been developed to meet the requests of R&D laboratories. These customers are always looking for a budget-conscious solution to build their development moulds, but also require a free access to the four sides of the mould in order to ease the manual preparation of inserts and the demoulding of parts. For this reason the new press has been designed with a lower platen shuttling in and out from the clamp, allowing for a lot of operating freedom around the mould. The design allows for both closed-mould resin injection or open-mould resin deposition, for maximum freedom. This new press, engineered with the use of FEA (Finite Elements Analysis) for the structural optimization of its parts, features platens of 2,500 x 1,200 mm, a clamping force of 6,500 kN, a stroke between platens of 3,400 mm and a parallel stroke of 1,000 mm. The 200 mm/sec operating speed, during both the shuttling phase and the closing operations, ensures high efficiency during the service time. Moulds weighing up to 20 tons can be used, guaranteeing a high degree of flexibility when some industrial pre-production (or production of small lots) is requested for short periods of time to an R&D piece of equipment. The parametric designs of this press allows for a prompt availability of models featuring a clamping force up to 10,000 kN, with platens’ length up to 3,100 mm or width up to 2,800 mm.

A new 1500 Tons press for industrial production

Another short-stroke press, featuring a 15,000 kN clamping force, has been recently supplied to a major German supplier of RTM parts for automotive applications. Characterised by platens of 2,500 x 1,500 mm and a max daylight of 2,000 mm, with a parallel stroke of the upper platen of up to 1,600 mm, also this model features a lower platen shuttling completely outside the compression area, allowing for an easy manual or robotic sequence of service tasks. The unit is destined to the industrial production of automotive parts for a major European car manufacturer.

A rich set of peripheral equipment, from a single source

This kind of press is usually the core of a complex moulding island, where several operations must be performed either manually or automatically: a lot of signal’s interfacing is demanded, and a unique supplier can avoid a lot of headaches when trying to put the puzzle together. Cannon developed a unique set of tools to be used with and around these complex machines, taking the responsibility of being for its customers a unique interface to deal with, during the plant definition phase and – later on – in case of complications in the set-up period. Moulds, handling systems and trimming or punching solutions for preforms and finished parts, dedicated preformers with patented slip-control methods, pre-heating and post-curing ovens, several methods for the impregnation of the reinforcements with various families of reactive chemicals, all the safeties around the working areas and a specific electronic control can be supplied as a turn-key package by Cannon Ergos, the Group’s company dedicated to the supply of complete parts to the plastics and Composites industry.