

INVENTIONS & INNOVATION

Success Story



INDUSTRIAL VACUUM BAGGING APPARATUS FOR COMPOSITE LAMINA MANUFACTURERS REDUCES ENERGY USE AND WASTE

BENEFITS

- Saves energy by reducing the occurrence of voids and air bubbles that ruin the product and result in recreating the piece a second time
- Payback normally occurs after only five uses and over 100 cures are possible in most situations
- Cuts costs per cure by approximately 40 to 50 percent if debulking is required
- Reuses the same silicon form for 100 to 200 production parts, reducing need for expensive disposable materials conventionally used
- Eliminates disposal costs
- Conserves petroleum feedstock
- Improves process uniformity and product quality
- Speeds production processes

“The DOE grant got our oven calibrated and revised our quality control manual, which enabled us to qualify as an approved source by Boeing, a watershed event for a company our size.”

—Cosby Newsom, President
Bondline Products



REUSABLE VACUUM BAGGING SYSTEM CREATES STRONG PRODUCTS ON THE FIRST TRY

While waiting for takeoff, have you ever stopped to marvel at the technology of flight? Incredibly, this flying machine takes you to 30,000 feet and then returns you to solid ground at another location. How are airplanes strong enough to withstand shearing stresses? The answer lies partially with the use of high-performance composite parts.

For the last 40 years, manufacturers of high-performance composite parts relied on a process of building up many layers of continuous-filament or woven-fabric lamina to create strong products. The layers were built by placing the lamina over a mold to shape the part and then repeating the process. However, this process often created air bubbles and voids in-between layers, which can act as stress concentration points and ultimately delaminate the material under high shearing stresses, resulting in rework and additional costs for the manufacturer. In most operations, a thin sheet of high-performance plastic film was placed over the lamina and a vacuum was used to squeeze out all the voids and bubbles after every few layers. The conventional practice in industry was to discard this sheet of plastic film every few layers, making this an expensive and wasteful process.

REUSABLE VACUUM BAGGING SYSTEM



Photo courtesy of Boeing NREL/PIX 09673

The RVB System has been used successfully to complete Boeing's RFI lower wing cover panel, which will be used for future transport aircraft design.

Solution

Bondline Products has devised a new technology, which employs a Reusable Vacuum Bagging (RVB) System to replace the thin-film and sticky-tape method that has prevailed in industry. This reusable vacuum bagger uses the same silicon form for 100 to 200 production parts, cutting costs by as much as 50 percent through reuse. The technology works by employing a patented keyhole and channel seal to create an airtight, separable joint between the channel, which is bonded to a tool base, and a keyhole, which is bonded to the flexible, silicone rubber diaphragm. The vacuum placed between the diaphragm and the tool base seals the part. The lay-up and tool can be placed into an autoclave to increase pressure to cure the part. The process requires no clean up and the keyhole seal and the channel separate easily to remove the part without scrapping any material. The tooling is then quickly ready to move on to the next part.

Bondline Products, under the leadership of inventor Cosby Newsom, was awarded a \$40,000 grant from the Department of Energy's Inventions and Innovation Program. The grant was used to create a video and handbook that provide practical manufacturing procedures for organizations that want to create Reusable Vacuum Bagging Systems at their facilities with materials supplied by Bondline. Bondline Products currently partners with some of the biggest names in the aerospace industry, companies like Boeing, Lockheed, Hughes, and Northrop/Grumman. Two United States patents protect the technology.

Results

Boeing uses the RVB technology on woven wing segments. These segments are so expensive to produce that Boeing cannot afford to lose a part during cure. Bondline's Auto-Vac Reusable Vacuum Bagging System was selected by Boeing and continues to perform without fail. This is the largest high-performance RVB system ever made.

The RVB system was first commercialized in 1985. Currently, hundreds of RVB systems, in all shapes and sizes, are operating in the United States, Germany, and Japan. Payback on this technology usually occurs after the production of the fifth part. The savings per part from that point on depend on the number of parts produced.

Bondline Products operates out of Norwalk, California, with 8 employees. The company's 1998 sales came in just under \$1 million.



The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and conduct early development. Ideas that have significant energy savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

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