



Reinventing the Wheel

New geared wheelchair wheel system makes uphill travel easier and safer for chair-bound people

A good wheelchair can be of tremendous benefit to a person otherwise unable to get around due to illness or injury. Most of us don't realize just how much pain and risk can be involved in their day-to-day use.

"Wheelchair propulsion is a highly complex movement that requires short, fast, continuous effort with both hands and both arms; the stress on the shoulders and wrists can be significant, and can cause people intense pain," explained Mechanical Engineer, Paulo Rodi of **Plásticos Mueller**, a successful injection molding company in Brazil. The biomechanical hazards, he notes, are greatly intensified as the user tries to climb a slope, with gravity increasing the effort required for movement, as well as adding the very serious danger of rolling backwards.

In late 2009, **Mueller** saw an opportunity to significantly improve wheelchair design with a new type of wheel system that, like a multi-speed bicycle, could use a gear system to make hill climbing easier. The wheel would automatically brake if the chair began to roll backwards providing a higher degree of safety.

"Our calculations suggested that we could increase safety and reduce the torque needed to move the chair by upwards of 50%," explained Rodi. *"This would greatly improve the mobility and quality of life for many people."*

But the **Mueller** team's mission quickly reached an impasse: the gears needed to stand up to extreme friction and stress.



To ensure long-term operation, the need for a specialized, super-tough, lightweight material was evident. Similarly, they soon realized that they would also need a specialized, high strength-to-weight material to ensure that the superior wheels could be maintained at about the same weight as the conventional wheels they planned to replace.

Fortunately, Rodi knew of **RTP Company** and made a call.

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"I have been in engineering for over 30 years and worked with many companies, and I have never seen a response like I got from RTP Company," said Rodi. "From the very beginning, they told us that they would put all of their resources at our disposal to solve this challenge, and they did."

Working alongside Mueller personnel both in Brazil and in China during the tryout phase, RTP Company soon developed compounds that met all of Mueller's criteria. These included an RTP Company compound with 30% long glass fiber, and RTP 4005 TFE 15 glass-filled polyphthalamide with PTFE lubrication. *"The local support of RTP technical staff to perform additional lab tests was remarkable during that phase."*

The result was dubbed the Mueller easyMOB® system, a geared 24" wheel designed to be fitted to most commercial wheelchairs. Rodi notes that Mueller established an extensive array of validation tests, and that the prototypes made with RTP Company compounds passed them all with flying colors.

"We ran the wheel on a dynamometer under heavy load at the typical 200,000 cycles, and were amazed at how little wear there was," he said. "So we ran it up to one million cycles, and it still performed brilliantly."

With wheelchair users delighted with the new easyMOB® wheels and high levels of interest in the system from wheelchair manufacturers around the world, Mueller is planning to create an expanded line of wheels using the same compounds and know-how they developed with the help of RTP Company.

"They are a fantastic partner, dedicated to succeeding by helping us succeed," noted Rodi. "Their expertise and willingness to help were just extraordinary. I don't think we would have had this level of success with any other supplier."

easyMOB® Wheelchair Gears

Market: Medical

Compound: RTP 4000 series glass fiber reinforced Polyphthalamide (PPA) with PTFE lubrication for excellent wear resistance.

easyMOB® Wheelchair Wheels

Market: Medical

Compound: RTP 100 series Very Long Fiber glass reinforced Polypropylene (PP).



Compact, high density lithium-ion battery delivers reliable energy wherever it's needed



Engineered POWER

R.W. Beckett Corporation has been a leader in the HVAC industry for more than 75 years. In 2010, looking to diversify their business and seeing an opportunity to leverage their extensive manufacturing expertise and electronic control technologies in a complementary industry, Beckett created a new division, Beckett Energy Systems, to commercialize an exciting lithium-ion (Li-ion) battery technology that was under development.

The ultimate product promised to be revolutionary—1.1 kWh of energy storage in a battery only 23.5" long, 8.25" wide and 2.25" high, and weighing in at a mere 17.5 pounds, opening up a wide world of application possibilities.

"No other lithium-ion battery offers this level of energy density, in so small and lightweight a package," said Beckett Energy Systems Product Manager Brad

Moore. *"By contrast, to deliver 1.1 kWh, a lead acid battery would be four times the size."*

According to Moore, a key link in the development of the large format, high density Li-ion battery was the design of an effective case. A complex moldable shape was needed to effectively contain and provide optimum stability for the 56 individual cells. It required just the right material to construct it.

"It was a tall order—it had to be highly moldable, high strength, impact resistant and flame retardant," explained Moore.

Part of the challenge was that the end product needed to be readily shippable by a variety of means in order to reach customers around the world, even those using the batteries at sea or in remote areas. However, in order for Li-ion batteries to be allowed on planes,

ships, trains, and most other forms of transport, they need to meet the safety requirements of United Nations section 38.3, which mandates that the product undergo a series of six stringent tests. These include severe vibration, followed by a 150G impact shock test on all six sides of the case, not to mention 6 - 12 hours under temperature extremes from -40°C to +75°C (-40°F to 167°F), an overcharge test and short circuit test.

The chosen compound, of course, would need to support the design in order to protect the integrity of the cells under all of these extreme exposures.

Senior Process Engineer Jeff Traczek got the names of several plastics compounders and entered discussions with them. But, he said, all but one compounder soon fell by the wayside.

"RTP Company was far and away the most responsive; they always got back to us right away with samples and the answers to our questions, and the answers were always good and helpful ones," said Traczek.

Using their Chinese facility, **Beckett** began molding with an **RTP Company** flame retardant (UL94 V-0) polypropylene. But soon, notes Traczek, **RTP Company** got another opportunity to demonstrate their responsiveness.

*"We were getting warped parts; I called **RTP Company** and asked them if they could get someone to our Chinese facility to help the molder optimize the process,"* he said. *"They stepped right in, and we were producing good straight parts in no time."*

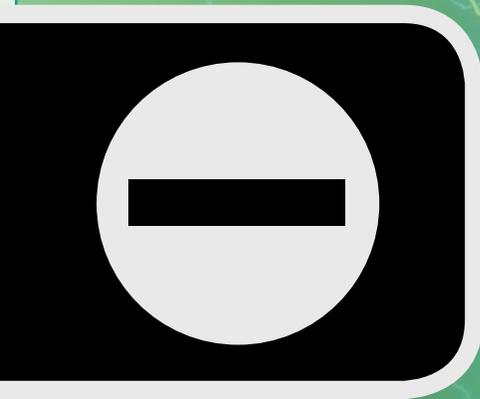
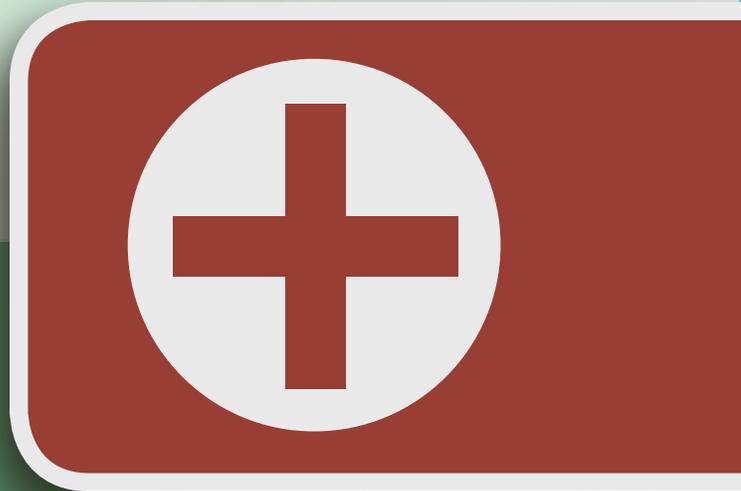
The new battery passed all the required tests and was recently commercialized, and the **Beckett Energy Systems** team has been working on developing new markets for the innovative high power/lightweight power source. Early indications have been extremely positive, with a clearly demonstrated market need for the revolutionary new battery in a wide variety of applications.

*"We really appreciate the proactive assistance we get from **RTP Company**. They are always responsive and always willing to go the extra mile,"* said Traczek. *"Those are the kind of people that make your job easier, and the kind of people that you want to be working with."*

LI-ION Battery Module

Market: Energy

Compound: RTP 100 series glass reinforced Polypropylene (PP) modified with flame retardant additive package.





Superior Conduct

After 20 years, company finds a high quality, reliable source for conductive plastic

Zefon International, a manufacturer of medical products and air sampling equipment used for monitoring indoor environments, takes great pride in the quality of its products. In fact, they have brought the entire production process, from injection molding to final assembly and packaging, in-house in order to maintain maximum control of the finished product.

Of course, they still need to source raw materials, and an ongoing issue with the purity and consistency of the carbon-filled conductive polypropylene they used for the manufacture of their asbestos air sampling cassettes was a concern for the quality-conscious company.

According to Kurt Kyvik, **Zefon's** Director of Product Development, the additional work needed to produce the cassette to their exact specifications was costing the company money. There was excessive material waste, excessive labor and even damaged molds due to the poor quality of the material they were receiving.

"I guess compounders find this conductive material particularly challenging to produce due to the high percentage of carbon required. We've tried a number of suppliers over the years, and in every case the material we've gotten has always been just passable at best," he explained.

Finally, after a few particularly poor batches, **Zefon** began a search for a new compound supplier, avoiding the suppliers that they had used before. They found three potential new sources, and **RTP Company** quickly stood out in their tests.

*"We immediately saw that the **RTP Company** material was significantly higher quality than anybody else's that we've come across in the more than twenty years we've been making this product,"* said Kyvik.

After testing, the compound, RTP 100 series Conductive Carbon Black Concentrate for Polypropylene (PP), became the new spec for the cassette. The compound met all OSHA requirements, and allowed **Zefon**

to reclaim a significant amount of time in the production process. Excessive waste and damaged molds became a thing of the past. In addition, notes Kyvik, the consistently high levels of carbon black in the **RTP Company** polypropylene helps **Zefon** attain several additional efficiencies in the blending process, saving them even more time and money.

"Finally," said Kyvik, *"we have a great source of high quality material for this product. We are very glad to have found **RTP Company**."*

AIR SAMPLE CASSETTE

Market: Industrial

Compound: RTP 100 series Conductive Carbon Black Concentrate for Polypropylene (PP)