

A New Dimension of Battery Performance

The Built-in Solution for Longevity
and High Capacity



Next Generation Batteries

Lead acid is a mature battery technology whose competitive edge is its cost-efficiency. As other technologies are becoming cheaper, however, they are beginning to take markets away from lead acid batteries. In this context, Crystal Control Technology® forms the next step in the evolution of lead acid technology, opening up new dimensions of performance as well as new markets.

Explore the Potential

Real-life operating conditions such as extreme temperatures or detrimental states of charge often put batteries under great stress. The resulting maintenance efforts and high exchange rates cause customers across major battery applications to set higher requirements on life cycle and overall performance. Crystal Control Technology® helps to meet these increasing standards by doubling the life span and tripling the capacity of lead acid batteries along with other operational benefits.

In some motive sectors higher battery stability would enable customers to extend warranty periods or offer service contracts. Due to the ever-increasing power demand of innovative technologies, car, bus and truck manufacturers often require a target of 250 charge cycles before battery capacity falls below 75%. Batteries equipped with Crystal Control Technology® far surpass this target and outperform untreated batteries by up to 100 cycles.

In other areas measures are taken to protect batteries against external influences. Telecommunications providers, for example, go to some expense to add temperature filters to their back-up batteries. While these measures cost up to several thousand Euros per battery pack, Crystal Control Technology® does not only protect batteries against the effects of a hot climate, but shows several additional benefits at a fraction of the cost.

Reap the Benefits

Excelling in performance, cost-efficiency, a longer useful life, higher margins—batteries with Crystal Control Technology® meet these goals at minimum expense. Besides increasing customer satisfaction and lowering warranty costs, the technology paves the way for new business. Service contracts become possible where this has not been lucrative before. In applications where lithium batteries are closing in on lead acid, Crystal Control Technology® widens the gap again by reaching life spans similar to lithium but at far lower purchase prices.

In the context of environmental protection, less frequent battery exchange helps meet governmental standards for emissions and waste. In Germany alone, nearly 200,000 tons of lead acid batteries were scrapped in 2014 and the emissions from recycling, logistics and the production of new batteries weigh heavily on companies' ecological footprints.

Integrate Progress

The integration of Crystal Control Technology® into batteries makes possible a new generation of lead acid batteries with improvements on all levels of battery performance. The technology can be applied to all types of lead acid batteries and its implementation requires little to no change of the manufacturing process.

A Crystal Control Technology® microchip is built into the battery lid. Depending on the assembly line and quantity, manufacturers either acquire a license for the technology to produce their own microchips or the complete lid is delivered ready to be welded onto the battery. Either way the integration of Crystal Control Technology® into a battery means a leap in battery evolution at maximum cost-efficiency.



More power for all applications—Crystal Control Technology® can be integrated in any type of lead acid battery.



Crystal Control Technology® at a Glance

Crystal Control Technology® leads to significant improvements in battery capacity and life span by manipulating the electrochemical processes in lead acid batteries. It enables surface control of the electrodes and increases the reaction sites.

Ageing in Lead Acid Batteries

Lead batteries store energy by means of a chemical reaction between lead and lead dioxide at the electrodes and sulphuric acid. The different electrode surface materials generate voltage. The most detrimental effects on battery capacity and useful life are the growth of lead sulphate crystals on both electrodes, which destroys the imbalance of the surfaces, and a lack of density in lead dioxide crystals on the positive electrode, which reduces the energy density.

During charging, lead sulphate is dissolved and the lead dioxide layer is renewed, but not completely. With every cycle, the unwanted crystals form an increasingly impenetrable barrier while lead dioxide crystals tend to bind to existing crystals in a heap instead of distributing evenly across the electrode surface. Over time, the battery loses its capacity.

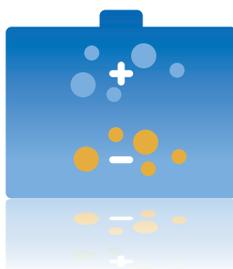
The Effects of Crystal Control Technology®

Crystal Control Technology® slows down battery ageing by using overvoltage pulses to manipulate the charging process. This creates more overvoltage at the battery electrodes and the additional energy in the electrolyte helps to increase the movement of the ions with three beneficial effects:

- Residual lead sulphate is more effectively dissolved from both electrodes, increasing battery life span
- Lead dioxide forms a more even coating on the positive electrode, increasing battery capacity
- Increased charge efficiency

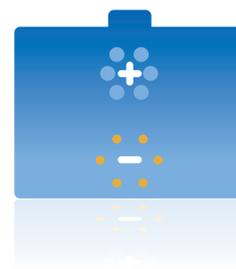
The stimulation of the battery's electrochemical processes improves its performance in various ways. Independent research institutes have tested the technology and verified its effectiveness. It has been validated by HORIBA MIRA Ltd. (UK), SINTEF Materials and Chemistry (Norway) as well as various battery manufacturers.

Ageing process in untreated batteries



- At the positive electrode, lead dioxide crystals form heaps that reduce the reaction site
- Lead sulphate crystals are not effectively dissolved and form a physical barrier on the negative electrode

Renewal with Crystal Control Technology®



- Lead dioxide forms an even coating on the positive electrode to renew the reaction site
- The increased ion movement effectively rids the negative electrode of lead sulphate crystals



Longevity

Crystal Control Technology® has been proven to double the useful life of batteries. Even when applied to worn batteries, it slows down the ageing process and stops it at about 40 - 50% rest capacity.



Higher Capacity

Even after repeated charge cycles, batteries treated with Crystal Control Technology® show 340% more capacity than untreated ones. Already weak batteries reach higher voltages again.



Improved Energy Output

Treated batteries produce a steady flow of high voltage to keep up with the power demand of the latest electronic consumers. The increased energy output also paves the way for the integration of additional electronic systems.



Optimised Charging Process

Due to higher capacity retention, batteries need less frequent recharging. They also charge about 14% faster and require 20% less current.



Reduced Downtime

Crystal Control Technology® reduces the harmful effects of deep discharge and undercharge by actively renewing the battery's reaction site. This makes batteries more reliable and minimizes downtime.



Less Sensitive to Extreme Temperatures

Although heat and extreme cold are among the most detrimental factors for battery performance, batteries are often minimally protected against ambient temperature. Batteries treated with Crystal Control Technology® have demonstrated improved stability and a longer life span under extreme climatic conditions ranging from -20°C to +50°C.



Balancing Effect

When batteries are connected in series without a battery management system, they often show strong variations in terms of energy output and discharge time. The technology has a balancing effect, which results in a homogeneous power supply and protects battery banks against the negative effects of charge imbalance.



Good for the Environment

Longer lasting batteries cause less waste and greenhouse gases. CO₂ emissions from battery production and recycling are thus reduced by 67% in addition to fewer emissions caused by maintenance, logistics and the like. This is how Crystal Control Technology® helps companies minimize their ecological footprint.

Find out more about
Crystal Control Technology®



An Investment that Pays Off

The integration of Crystal Control Technology® opens up unprecedented possibilities in terms of margins, customer satisfaction, cost-efficiency and markets. At the same time, it has little impact on the manufacturing process. Discover how a minor investment offers major advantages.

Implementation Options

Compared with the development of a new battery type, the integration of Crystal Control Technology® incurs little cost. It saves expense on research and development, since the technology is proven and the product ready for integration. Laboratory and field tests have verified the technology's beneficial effects.

The technology can be incorporated into any existing battery type without any change to the assembly line by purchasing the whole battery lid with Crystal Control Technology® inside. For a perfect fit, the lid is specifically tailored to the battery. It is delivered ready for welding onto the battery. In order to keep the whole production process on the company's own premises, manufacturers can purchase a license and produce the microchip themselves.

Increasing Margins

The improvements in terms of life span and capacity retention greatly enhance the product's value. While the batteries last twice as long and their overall capacity is three times as high, the production cost increases by only a fraction. Crystal Control Technology® thus opens up the possibility of higher margins for existing battery types.

Without Crystal Control Technology®



With Crystal Control Technology®

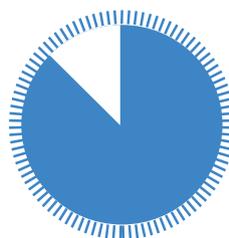


Extending Warranty Periods

In applications with longer standstill times, batteries frequently fail within only a few months after installation. Warranty costs are accordingly high, which prevents manufacturers from offering longer warranty periods. Crystal Control Technology® protects the battery from inside and helps reduce costs. As a result, warranty periods can be extended to increase customer satisfaction.

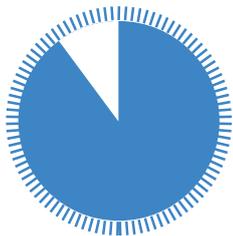
Longevity and high capacity retention are also strong sales arguments for customers whose warranties or service contracts include battery replacement. The typical service contract for a long-haul truck, for example, has a four-year term. During this time the accumulated direct and indirect battery costs amount to €3,180. Battery failure and problems with cold cranking cause immense costs for spare parts, roadside assistance and related tasks. Crystal Control Technology® reduces these costs by 50%. In field tests, the technology effectively prevented battery failure and starting problems for over two and a half years despite very cold weather, high energy consumption in stand-by mode and other typical operating conditions.

Decreasing Operating Costs



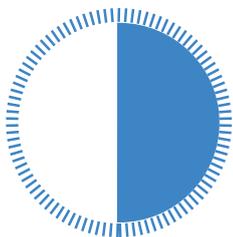
20% less energy for charging

Battery use and replacement are accompanied by costs for energy, spare parts logistics and other service and maintenance costs. Crystal Control Technology® leads to significant savings in indirect battery costs. Due to improved charge acceptance, treated batteries generally consume 20% less energy for charging.



10% less fuel consumption

In an uninterrupted power supply, dwindling discharge times necessitate the assistance of a supporting diesel generator running for more hours. Fuel costs then account for up to 60% of all battery costs. Crystal Control Technology® reduces fuel costs by 10% by slowing down discharge time and the ageing process.



50% less roadside assistance

Roadside assistance is one of the major cost factors in battery failure for trucking companies ranging from a few hundred to over a thousand Euros depending on where the incident takes place. With Crystal Control Technology®, failure due to ageing occurs only half as often and batteries are powerfully protected

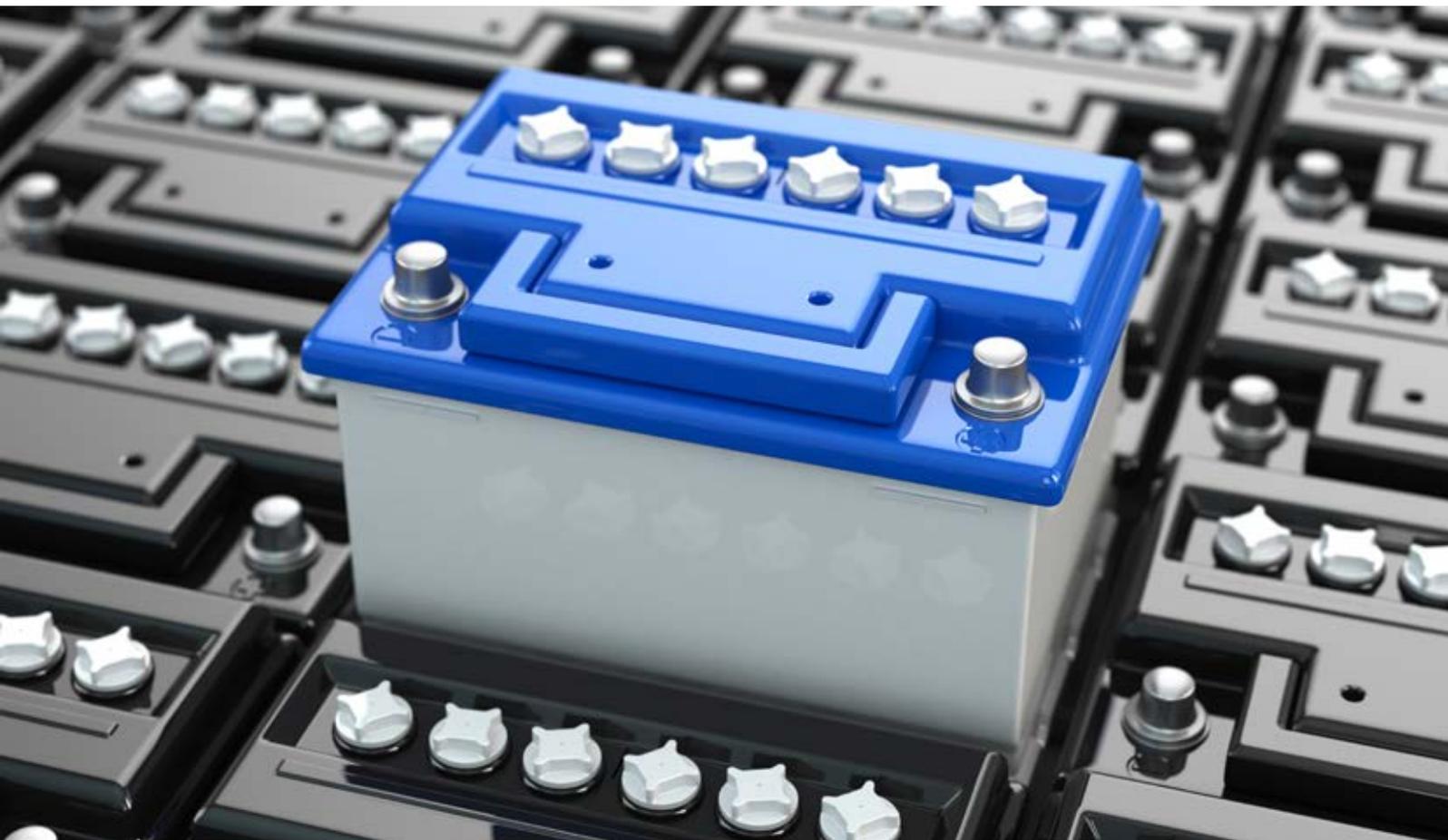
against cold cranking problems. Buses using the technology did not require assist-starting once in over two years, while this had been required on an almost weekly basis without Crystal Control Technology®.

New Markets

Especially the longer life span of batteries with Crystal Control Technology® opens up new business opportunities. Service contracts can be offered to bind customers on a long-term basis in fields where this has previously not been lucrative.

Markets that are dominated by lithium technology become attractive, because lead acid batteries with Crystal Control Technology® offer similar life cycles at a far lower price. In energy storage, the cost per kilowatt-hour of lithium and lead acid systems is similar. Lead acid batteries are only half the price, but need to be replaced twice as often. The use of Crystal Control Technology® clearly tips the balance towards lead acid. The storage cost per kilowatt-hour is 50% lower than that of both, conventional lead acid and lithium.

Crystal Control Technology® is integrated in the form of a microchip in the battery lid.





Crystal Control Technology®—Game-changing Batteries for Demanding Markets

- Surpassing the standards for battery capacity
- Optimizing margins by enhancing product value
- Increasing sales with more competitive prices
- Reducing direct and indirect battery costs by about 50%
- Discovering new business opportunities

For the Best Connection

Contact our experts at WaveTech for more information on our technology and products. We will be happy to advise you according to your special requirements!

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WaveTech was founded in 2003 with the ambition to take battery efficiency to a higher level. Expert knowledge and innovative strength paved the way for the development of Crystal Control Technology®, which forms the basis for the BEAT® product family. With a clear focus on research and quality, the German-based company provides solutions for a broad range of battery applications in the telecommunications, automotive, power storage and other sectors.