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## **Zoz nanostructure for Christian Monumental Building in Mexico**

Mexican delegation already 2018 (OZ-18) at Wenden townhall, construction starts 2021/22.

Breakthrough for Zoz FuturZement|FuturBeton. 10 years "after" the Rosenthal Bridge !

### **Wenden/Zacatecas/Guadalupe**

This month the magazine LIDER®Empresarial in Mexico reports on a monumental building planned over many years in the State of Zacatecas in central Mexico. An essential handshake for this in fact happened in March 2018 at the Wenden townhall in Germany.

The capital of the same name, Zacatecas, is located 2.440m above sea level, 2km higher than Wenden (411m), almost as high as the Zugspitze (2.962m, highest mountainpeak in Germany) and is known as one of the richest Mexican silver cities. The city is located on the former Silver Road (Camino de la Plata) between Mexico City and Santa Fe in New Mexico (USA), a UNESCO World Heritage Site under the name "Camino Real de Tierra Adentro". Zoz received the IberoAmerican Silver Award 2012 right there.

The Federal State of Zacatecas counts around 1.7 million inhabitants at less than 22 inhabitants per km<sup>2</sup>, 10 times less than in Germany. The largest city is not the capital Zacatecas (130.000 inhabitants), but Guadalupe with approx. 150.000 people. Both city centers are only 1 km away, the two cities have virtually grown together.



Here the "Santuario a la Virgen de Guadalupe, Columbario Monumental", thus the Sanctuary of the Virgin of Guadalupe as a Monumental Columbarium, is under construction in the coming years.

The burial chamber structure will reach 20m, the rising statue 60m, the resulting total height is 80m. The statue is built with high-strength, extremely durable and also low-CO2 "FuturBeton", thus using green Zoz Technology from Wenden/Germany. Therefore you can find the Zoz-CEO in the center of the picture on Lider®-cover.

### The Virgin of Guadalupe & Fondo Cultura Zacatecas.

With around 20 million pilgrims annually, the Virgin of Guadalupe constitutes the world's largest pilgrimage site representing the Mexican Madonna. This not in Guadalupe in the state of Zacatecas, but in Mexico City. History goes back to the 16th century, to the most important Marian apparition for Christianity in America and a miraculous image on the Tepeyac hill in Mexico D.F., where today the Basilica of Guadalupe stands at the foot of that mountain. The recipient/seer Juan Diego was beatified in 1990 as the first Indian in church history by John Paul II and canonized in 2002. The Virgin of Guadalupe is the patroness of Mexico and the entire Americas.

Here the investor consortium „Fondo de Cultura de Zacatecas” under the direction of Dr. Gerardo Salmón de la Torre at Guadalupe in Zacatecas plans to have tourism flourish in the state of Zacatecas with the monumental building project. With this huge investment, Zacatecas is likewise supposed to become the home to high technology, something that with such “demonstrator” should be achievable. It starts with FuturZement|FuturBeton, to be followed by other nanostructured materials that all will be realized in a Technology Center in Zacatecas under the participation of Zoz.

### Zoz, Japan and Mexiko.

If faraway countries have characterized Zoz, then Japan and Mexico are right at the forefront. In Kusatsu/Kyoto, Zoz served for a long-time as a professor at Ritsumeikan University and co-founded the German-Japanese Symposium Nanostructures, today the German-International Symposium Nanostructures. Japanese as well as Mexican scientists spent time at Zoz at Wenden and Olpe for research stays, Zoz a lot of time, partly with family, in both countries.



Zoz and Diaz, ZTC at Olpe/Germany, October 2015

In Mexico, Zoz did his doctorate at CIITEC/IPN and almost two decades ago, particularly together with the current institute director Sebastian Diaz de la Torre (Lider®-cover to the left of Zoz), repeatedly investigated into high-performance cement. Right in Zacatecas, Zoz was awarded with the IberoAmerican Silver Award in 2012 and during the German-Japanese / Intern. Symposium 2018 (OZ-18) at Wenden/Germany by handshake with Dr. Gerardo Salmon (Zacatecas Fondo Cultura, Lider®-cover, 2nd from left), the collaboration in the project “Virgin of Guadalupe with the processing of high-performance materials” was sealed.



Calderón Theatre, Zacatecas, 05.12.2012



Salmon, Zoz and Diaz, OZ-18, Wenden, 06.03.2018

The insofar first statue made of high-performance cement is only a few cm tall, dates back to 2003 and clearly shows the advantages of improved flowability and at the same time, higher early strength of a new building material with the visible result of excellent surface properties in complex structures.



Sculptures, conventional cement (OPC, left) and high-performance cement (HPPC, right), 2003, CIITEC, S. Diaz

Removing formwork of Zoz FuturBeton-Eagle together with Environment Minister Remmel, ZTC, 04.02.2015

The extremely short and adjustable "setting time" of just 2-3 minutes is also impressive. Later, Zoz started to research with much larger models, such as several sculptures on the front balustrade of Villa-ZCS (Zoz location at Siegen, balustrade also made of FuturBeton) or the Zoz FuturBeton-Eagle.

**Zoz Group, materials- and product-innovations from Germany.**

The FuturBeton-Eagle, in this case with a "gold layer", was presented to the general public for the first time at 2015 Hanover Fair. FuturZement|FuturBeton represents one of the "exotic" product areas to which e. g. also the generation of natural rubber from dandelion roots or, more recently, from banana peels, belongs.



with Economics Minister Duin at the Zoz booth, from Hydrogen to FuturBeton-Eagle, Hanover Fair, 13.04.2015

At the same booth, Zoz presents an industrial plant for producing nanostructured materials (Simoloyer<sup>®</sup> CM100, photo on right, green/black, partially covered), a corresponding laboratory unit CM01 (photo on left, silver/black), a vehicle from the Zoz-ZEV Fleet (front wheel visible between Zoz and Duin) with a Stromkoffer|IronBird (hydrogen power unit) in the trunk.

Zoz, headquartered in Wenden/Germany, develops and manufactures equipment for mechanical process engineering, in particular high-kinetic processing devices (HKP, Simoloyer<sup>®</sup>) for producing nanostructured materials.

Processing plants are supplied all over the world and also operated in-house at Zoz for developing and manufacturing highly specific powder materials from kilo to tons scale. These powder materials are supplied globally and/or used still in-house, in order to be further processed into PM semi-finished products, components or layers.

In result, the product range extends from innovative process technology to nanostructured high-performance materials with sometimes completely new properties, up to solution-oriented components for the end user market.



The latter can be super lightweight material (Zentallium®), high-performance magnetic filters (NdFeB), Li/Ion battery cathodes and materials (ZoLiBat®), hydrogen solid state storage (Hydrolium®), hydrogen tanks (H2Tank2Go®), hydrogen drives and vehicles (Isigo®H2.0) up to the Power to Gas to Fuel infrastructure (P2G2F®, Zoz ZEV vehicle fleet).

For glass industry, turbine manufacturing and nuclear fusion, Zoz develops and produces high-temperature alloys, particularly oxide-dispersion-strengthened alloys ODS/NFA, namely PM2000 (19YAT), PM2017 (20YAI) and PM2018 (14YWT). On top of these Fe-based materials, the portfolio also includes nickel and, more recently, titanium-based ODS alloys.

Ductile Metal Flakes (DMFs) and paint systems based on those (Zoz DeutscheFarben) represent an important field. The spectrum does range from zinc or zinc-aluminum for anti-corrosives to silver or gold for micro-soldering (electronic packaging). In mechano-chemical processing, complex chemical reactions are carried out specifically environmentally friendly where e. g. active substances are produced. Safe and clean decontamination, e. g. of dioxins plays also a role here.

The powder and component manufacturing is located at the Zoz Technology Center (ZTC) at Olpe/Germany. Zoz entertains representatives in 11 and branches in 6 countries, is on the list of hidden champions Germany and subject to constant monitoring by the Federal Office for Export Control.

### Success despite Corona | from banana to nuclear fusion

Zoz has overcome the Corona politics well so far, no short-time work, no layoffs, instead new hires and, for the first time, to the turn of the year between the days no company shutdown.

From December 2020 until Mai this year, the largest process plant at ZTC, where the new product “natural rubber from dandelion roots” has been created for years for and then of a large tire manufacturer, was running in 3-shift operation 24/6 producing high-performance material ODS/NFA for an American turbine manufacturer.

A similar next order, in this case for nuclear fusion, already came in from the United Kingdom. The mechanical engineering dept. at Wenden is busy with orders for the US military in 2021.

Most recent patent applications together with the Fraunhofer Institute IME relate, among other, to natural rubber made from banana peel. For this purpose, a user, e.g. seal manufacturer is wanted.

### Honors | Hydrogen and Battery

For similar “asynchronous success” during the banking crisis, the Zoz-CEO was awarded as the Manager of the Year in South Westphalia in 2011. Locally, the Sauerland Innovation Award for Zoz solid-state hydrogen storage (Hydrolium®, H2Tank2Go®) followed and later the Hydrogen & Energy Science Award 2019 in Korea.

In 2019/2020 Zoz started to equip an Asian car manufacturer with hydrogen technology from Wenden, this stopped with Corona. On the other hand, a major order for (automobile) battery cathode materials (LMP/LFP, ZoLiBat®) was lost. However, an associated laboratory unit at least could have been delivered early this year.



with Federal Economic Minister Rösler at a Zoz hydrogen scooter in front of a Zoz-ZEV, August 29, 2013

### **The best that is in the box.**

Acc. to Zoz, the "the best that is in the box" is something else, moreover exactly where one has been far too unsuccessful since years. In 2016 still sent by Peter Hintze, at that time State Secretary at Federal Economics Minister Rösler, to the President of the German Institute for Structural Engineering, initially disillusionment had to be learned. Even economically and ecologically convincing innovations, even at a given political will, can be subordinated to existing structures, monopolies and cartels. The way was expected to be long.



Since that time, Zoz has been traveling all over the world to bringing technology for "green high-performance concrete" based on super-activated aggregates as a sustainable and cost-neutral innovation, that everyone needs, into the mass market.

Particularly in the age of CO2 religion, where highly developed diesel engines are sacrificed towards economically and ecologically considerably less favorable battery drives, one should realize that one starts where something can be achieved. If the cement production would be converted accordingly, in any case more CO2 emissions could be saved than ever could be saved in road traffic. Instead, billions in economic losses are accepted in mobility, an entire industry is migrating out of the country, possibly because the experts might have never been interested in building materials.

## FuturZement|FuturBeton

Since November 2012, the bridge Rosenthal, made of Zoz-FuturBeton, has been in place at Olpe County. As another demonstrator weighing tons, the balustrade of the Villa-ZCS was installed at Siegen in 2013.



2009 to 2012, Zoz GmbH carried out the BMBF research project 03X0068A, entitled: "Nano-scale activation of blast furnace slag and Portland cement by means of an innovative grinding process for the production of high-performance and ultra-high-performance concrete with improved properties."

The project short name is: **FuturZement|FuturBeton**.

FuturBeton today at up to 140MPa, is 3-4 times stronger than conventional concrete, impresses with its extremely high (adjustable) early strength and durability of presumably several hundred years. Conventional concrete structures usually fail after 50 years, compare e.g. to the A45 Autobahn bridges in Germany.

The enormous durability, mainly results from a substantial refinement of material porosity, moisture can practically not penetrate. The strength in UHPC range is due to the upfront super-activation, in this case of granulated blast furnace slag (GGBS), which is admixed to conventional cement (OPC) in a certain ratio.

This was and is done at ZTC at Olpe in nanostructure processing plants that Zoz develops and produces at Wenden.



...with the ProgressReport FuturBeton, Federal Minister Wanka (BMBF), 16.05.2013

Utilizing blast furnace slag, additionally an approx. 20% reduction in CO<sub>2</sub> emissions (less calcination of clinker) is resulting. Since cement on partial view represents the largest CO<sub>2</sub> emitter of mankind, the effects are enormous. If you want to save CO<sub>2</sub>, you should start right here, and not at the already super-clean diesel engine.

Since FuturZement in concrete causes additional costs of <€10/ton of concrete (DE-2012, 43.000 tons p.a.), since due to higher strength, less material is required, since due to higher early strength one can build faster and due to high durability one can build less often, the supposed CO<sub>2</sub>-problem could be solved almost free of charge. Even more, one can build more cost-effective and sustainable. One just has to really want that.

### OZ-18 at Wenden, Mexico at Wenden/Germany

The annual Nanostructures Symposium was held for the first time in 2008, initially alternating between Germany and Japan every year. The OZ-18 was the 10th Symposium at the beginning of March at the Wenden town hall (today at Olpe town hall). The Symposium is a small but fine and highly specialized event.



OZ-18, Prof. Diaz & Sen. Mendoza (li), with Lucia Mazzocca & Dr. Salmon

Mexico Delegation at Wenden town house

So in 2018 (OZ-18), 64 contributions from 19 countries were published, the accompanying exhibition counted 35 exhibitors from 11 countries. Addresses to the event were provided from Federal Minister of Economics Zypries and EU Commissioner Oettinger, from the HSF of the United Nations, Prof. Töpfer, from the Chairman of OttoBock, Prof. Näder, from the President of the Fraunhofer-Gesellschaft, Prof. Neugebauer and from the CFO of Lamborghini, Paolo Poma.

Very special in 2018 has been the contribution from Mexico. At the Wenden town house, Sen. Enrique Flores Mendoza, the Mayor of Guadalupe, welcomed the attendees at translation support by Prof. Sebastian Diaz. Additionally he presented greetings from S. E. Alejandro Tello Cristerna, Governor of the State of Zacatecas (Lider®-cover, 2nd from right), as a video message. The Mexican delegation was led by Dr. Gerado Salmon. Prof. Diaz's contribution to the conference was entitled: Design and construction of the world's largest "Virgin of Guadalupe" statue using high-performance concrete. 2018 has not been the first time that a Mexican delegation visited the Sieger-/Sauerland for this major construction project.

### HEMZA, Zoz & Zacatecas

Already in 2015, FuturBeton processing with the manufacturing of a FuturBeton-Eagle was successfully demonstrated within a two-day visit at ZTC at Olpe. Of course, the Rosenthal bridge at Olpe, the largest demonstrator to date and the Villa-ZCS at Siegen, with the second-largest, were also inspected.



13.-14.10.2015: Mexican Delegation at ZTC

with the manufactured FuturBeton-Eagle (on left)

Preceding had been many meetings in Mexico City and Zacatecas as well as in Cancun. Here, Diaz and Zoz were involved for years in the organization of the annual Mexican materials conference IMRC.

Over the years, many project ideas have been developed to "undertake" Zoz technology and modern, innovative economic performance in Mexico. The priority was and is to create synergies from existing resources and new ideas.



Diaz & Zoz with Prof. Hans Fecht and Capt. Orlando Obeso (Cancun 2015), with Karina Rodriguez and Dr. Salmon (Zacatecas 2013), Cancun (2008), with Prof. David Vigueras and Dr. Enrique Martinez (Mexico City and Cancun 2004)

Locally, Zacatecas emerged as the best possible region for such project and the group of key players joining in 2015 under the Mexican-sounding synonym HEMZA became more permanent. However, HEMZA stands for “High Energy Milling Zacatecas.

High Energy Milling (HEM) describes together with Reactive Milling (RM) and Mechanical Alloying (MA) the historical process names for High Kinetic Processing (HKP). And this is exactly how nanostructures are produced at Zoz, including FuturZement|FuturBeton.

### **Virgin of Guadalupe at Zacatecas, Importance for Zoz and Technology**

Zoz is the father of five children and a member of the Catholic Entrepreneurs Association. This already explains the natural interest in being allowed to participate in building the largest statue of saints in Mexico, significantly larger than the Christo Statue on Corcovado at Rio de Janeiro (39.5m) or the Statue of Liberty at New York (37m).

For Zoz, this huge construction project provides the unprecedented opportunity to bring “the best that is in the box” to the market in large-scale. The symbiosis of culture and high technology will help to break up outdated structures, syndicates and habits, to the benefit of people and environment.

Just as the Apollo program resulted in many innovations not only for US-Space, but also for virtually all civil society on this planet, the “Virgin of Guadalupe in Zacatecas” will result in a technological innovation boost for all Mexico. In Zacatecas, a joint technology center (HEMZA) will be created, which does not only ensure, that a FuturZement production facility is set up as quickly as possible. At high priority, it is e. g. to be investigated, whether a segment construction in additive manufacturing will be possible for the surface of the statue. In positive case, the development is carried out on the spot.

Since HEMZA will be able to produce nanostructures specifically and scalable, this know-how will of course be considered for all other possible innovative business areas.

### **Nanotechnology finds its way to silver city.**

Ultra-thin silver flakes, manufactured via HEM with applications in conductive pastes or adhesives, particularly for micro-soldering (electronic packaging / semiconductor industry), should therefore be on the agenda quite soon.

The expected export hit HEMZA-FuturZement will be followed by other high-performance materials from Zacatecas. To that, also the strategic location of Mexico will contribute. In this respect, just in summer 2020, the USMCA (United States Mexico Canada Agreement) free trade agreement came into effect as the succeeding agreement to NAFTA (North American Free Trade Agreement). Should Mexico achieve a significantly better carbon footprint than e. g. every European country, and that comparatively free of charge, this could turn out to be politically advantageous.

All of this will result in exactly what the rulers of a society have to worry about. That is prosperity for the people.

**There's a lot to do, let's take care of it.**