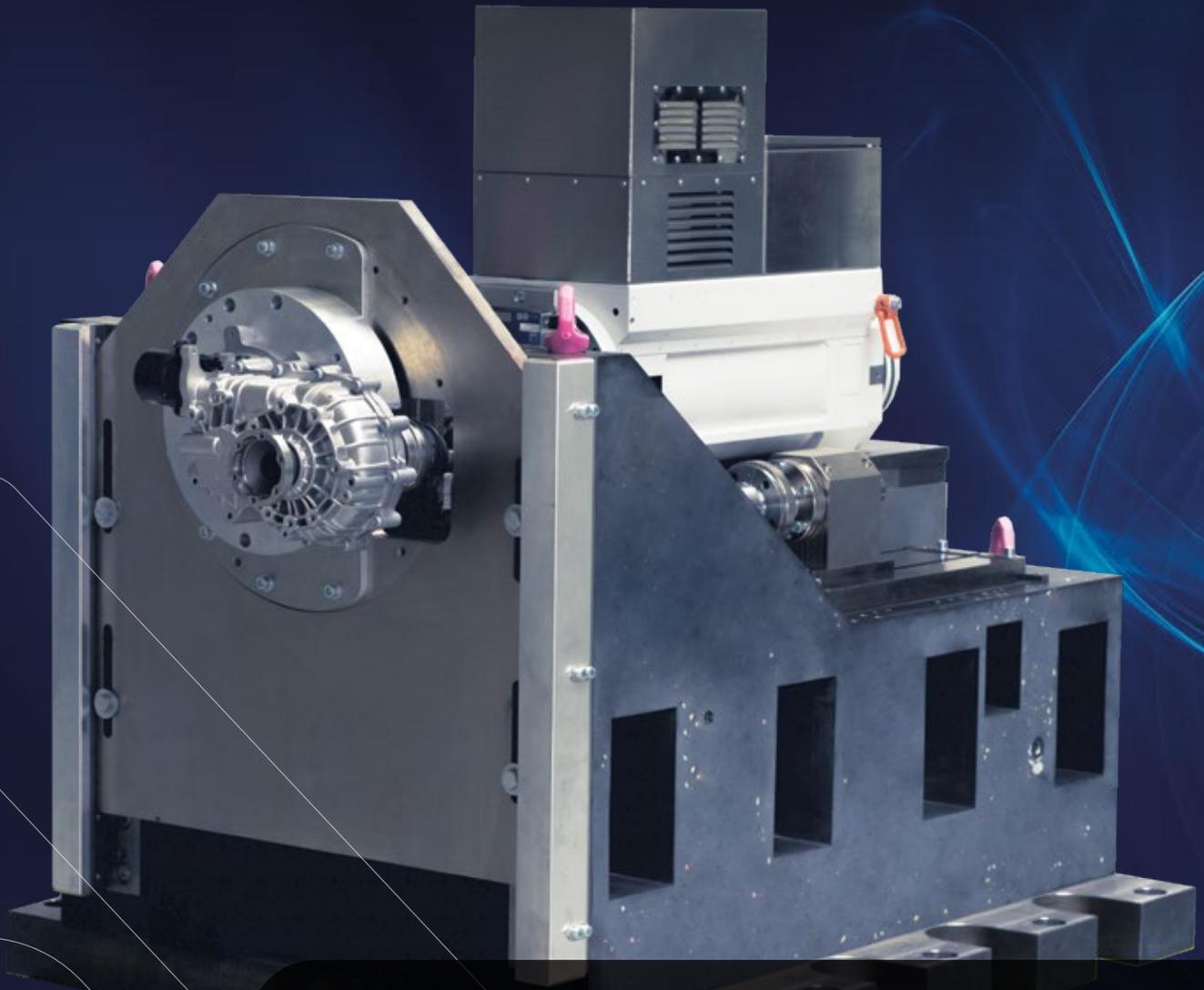


# NEWSLETTER

English Version | 09/2020



## ADVANCED TECHNOLOGY

New development of a height-adjustable  
polymer concrete machine base  
for high-speed test stand applications

**Filled with positive energy,  
we continue to work on the  
successful concept of the  
GTSYSTEM family.**

## Greetings from Germany



In the times of the Covid-19 pandemic worldwide, the amount of bad news is present to all of us through the media on a daily basis. I would like to take this opportunity to thank our employees in particular that we in the GTSYSTEM family have come through this crisis unscathed and I would like to emphasize that we all remain vigilant.

In addition, the international positioning of our company with GTSYSTEM Suzhou Ltd. proved to be a vital prerequisite for the implementation of major international projects during the Corona period. Especially when personal „on-site operations“ were actually unavoidable in the project plan, but are not possible due to Corona, we were able to complete all the customer-relevant approvals on the test benches to be delivered by our international team and the existing digital channels exactly according to the schedule.

We are proud of the fact that we in the GTSYSTEM family have reliably kept our delivery promises to our customers in the currently very difficult economic situation of the entire supplier industry.

After the Corona Lock Down, the Chinese economy had a lead of approx. 2 months compared to the European Union for an initial consolidation. That is why we at GTSYSTEM see the new projects from China as more than a first silver lining on the horizon in terms of the overall economic outlook.

Filled with positive energy, we continue to work on the successful concept of the GTSYSTEM family. With continued high development demands on our leading technology and the special customer support, I would like to thank all customers for their trust!

**Be excited and above all stay healthy!**

Dieter Apold  
Managing Director GTSYSTEM GmbH

## Greeting from China



**Soon we are experiencing an increasing business stabilization. This was only achieved by the tremendous effort by all our team members.**

From our subsidiary GTSYSTEM Suzhou Ltd. I am pleased having few words to you about the latest release of our newsletter. First, I like to draw your attention to the big move for all of us that nowadays the real testing exhibition show in Shanghai can perform.

This symbolizes that after the hard times of COVID-19 things changing into the right directions (for the Asian/CN markets). Generally, in the Asian markets, especially in China, first signs are visible for economy's growth start, e.g. increasing demands for new vehicles, whether with traditional ICE or NEV drivetrains. Currently those sales figures already at a higher level compared to Summer 2019.

Looking at recent export rates and turnover of China's economy all the indications are showing positive (local) trends reaching the same bustling figures as last year, referred to the equal period.

For GTSYSTEM China after going through the pandemic's peak time, now the situation is also slightly improving and soon we are experiencing an increasing business stabilization. This was only achieved by the tremendous effort by all our team members, by the whole company's organisations in China and of course in the German HQ, too.

Therefore, from management side we are expressing our deep gratitude to all our employees' best motivation and their full loyalty during those past hardworking times.

**This strong attitude has kept our company's overall business fully operative and able for continuously servicing to all our customers' needs:**

Actually, the service works via our support team were re-established, contacts to the customers by our PMs, Sales and support teams were intensified as well as more ideas for better customer's benefits developed.

**Besides our business areas as a highly specialized test bench integrator, GTSYSTEM covers high-tech test bench applications or acting as service provider, too:**

Here I like to mention the newly developed Swivel test bench application for powertrains in the heavy duty field, but also the new established worldwide GTS Support Service incl. new ticket tracking system for a thoroughly follow up of any inhouse and external customers' issues.

**Apart from all technical competencies the Korean Market has been opened by global GTSYSTEM during the last half year. Here we already see huge progresses on this new market ground, even though the pandemic situation could not impede us to follow our plans:**

Now with new Korean headcount at our global GTS world we will precisely cover the Korean market and customer's demands.

Please take a closer look to our newest release of GTSYSTEM newsletter and discover more interesting details.

**Yours sincerely**

Roland Kreies  
General Manager GTSYSTEM (Suzhou) Co., Ltd

# ADVANCED TECHNOLOGY NEW DEVELOPMENT OF A HEIGHT-ADJUSTABLE POLYMER CONCRETE MACHINE BASE for high-speed test stand applications up to 25.000 rpm



Author: Mr. Dirk Horsch  
Project Manager



Author: Ms. Jennifer Przybylski  
Team Leader Mechanical Engineering

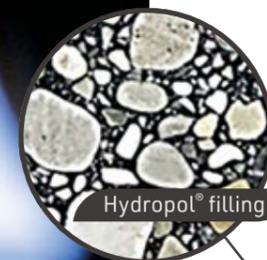


Nowadays, the established, proven and FE calculated welded steel design for dyno base frames is no longer sufficient, due to low natural frequencies and limited damping characteristics in times of high-speed testing applications in the speed range above 20.000 rpm. Alternative material solutions with higher damping properties are required.

In close cooperation with the companies framag and Krebs' Engineers, a height-adjustable dyno base frame for electric motors was developed, in which decisive components consist of a polymer concrete construction. Polymer concrete differs from conventional concrete in that no cement but a synthetic material (polymer) is used as a binder material. Thus, there is no cement matrix, but a synthetic matrix which holds the aggregates together in the concrete (Fig. 1). The described material structure leads to the mechanical properties listed in Table 1. The significantly lower density compared to conventionally used materials such as structural steel and nodular cast iron leads to a lower total weight, which, together with the damping properties of the polymer concrete, has a significant influence on the dynamic operating behaviour of the component.

	Unit	Polymer-concrete	Nodular cast iron	Structural Steel
<b>Density <math>\rho</math></b>	g/cm <sup>3</sup>	2,5	7,11	7,85
<b>Yield strength <math>R_e</math></b>	MPa	2,41	310	185
<b>Tensile strength <math>R_m</math></b>	MPa	2,41	448	310
<b>Elastic modulus <math>E</math></b>	GPa	60	162	210
<b>Poisson's ratio <math>\nu</math></b>		0,25	0,275	0,287
<b>Shear modulus <math>G</math></b>	GPa	14,8	63,53	81,59

Tab. 1 | Comparison of the mechanical characteristics of polymer concrete to structural steel and nodular cast iron



Hydropol® filling



Fig. 1 | machine base with framag HYDROPOL® filling

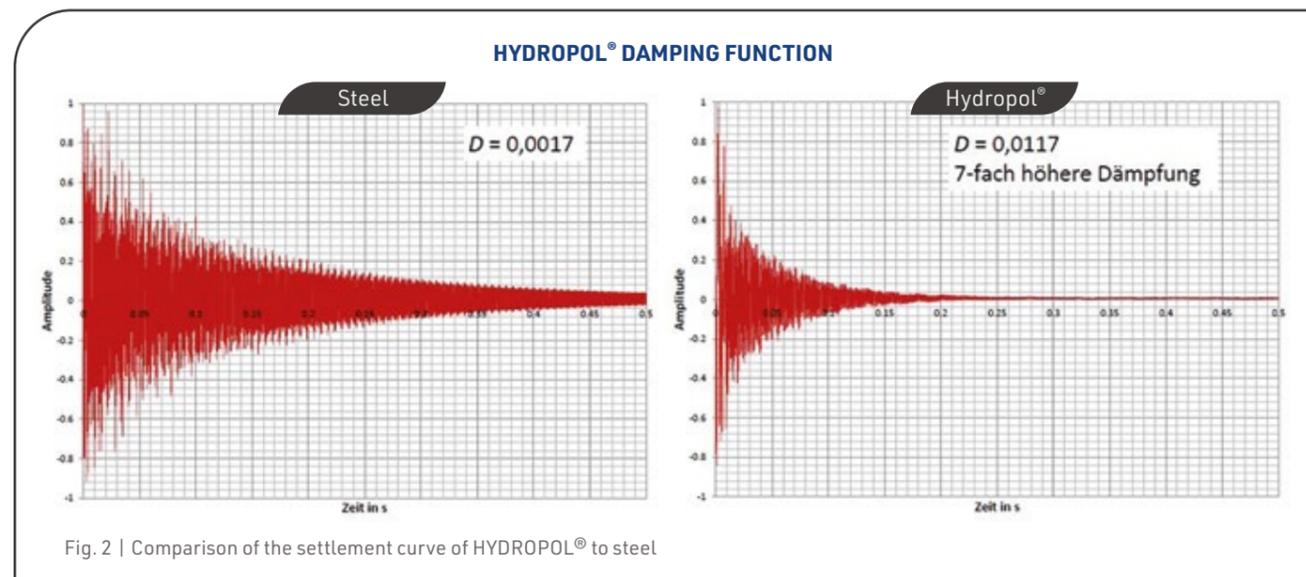


Fig. 2 | Comparison of the settlement curve of HYDROPOL® to steel

HYDROPOL® is a combination of a welded steel jacket filled with high-quality composite materials, which was developed by framag especially for vibration damping. It has up to 7 times higher damping characteristics compared to steel (Fig. 2 and Fig. 3).

HYDROPOL® can be optimally adapted to the respective, individual requirements by means of different „formulations“. Examples for the variation of mechanical characteristics are the two formulations HYDROPOL LIGHT® and HYDROPOL - SUPERLIGHT®.

In addition to the variable modulus of elasticity, HYDROPOL® has a high thermal stability and heat capacity. A particular benefit is the possibility of conventional mechanical processing after casting process, so that, for example, necessary threads can be inserted subsequently instead of planning thread inserts before the casting process.

**DAMPING OF MATERIAL**

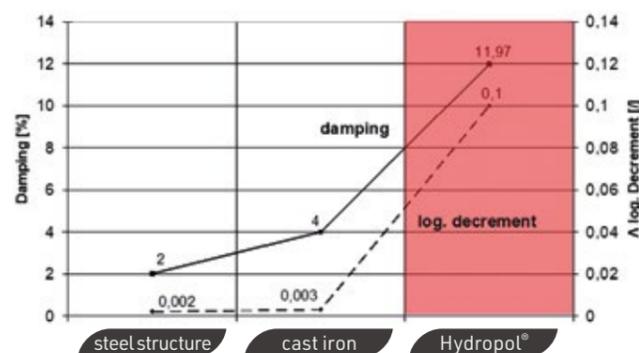


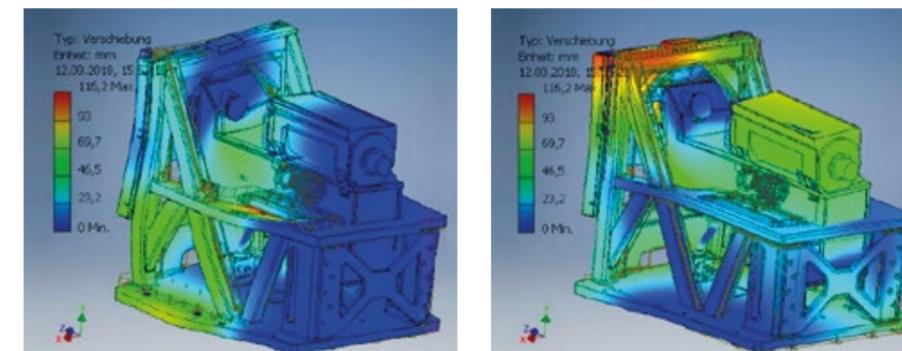
Fig. 3 | Damping characteristics of HYDROPOL® to cast iron and steel

	<b>HYDROPOL®</b>	<b>HYDROPOL LIGHT®</b>	<b>HYDROPOL SUPERLIGHT®</b>
<b>DENSITY</b>	2.500 kg/m <sup>3</sup>	1.200 kg/m <sup>3</sup>	700 kg/m <sup>3</sup>
<b>E-MODULUS</b>	≥ 60.000 N/mm <sup>2</sup>	≥ 12.000 N/mm <sup>2</sup>	≤ 6.500 N/mm <sup>2</sup>

Fig. 4 | Range of variation of mechanical characteristics of HYDROPOL®

Fig. 5 | Welded steel construction – height-adjustable solution from GTSYSTEM

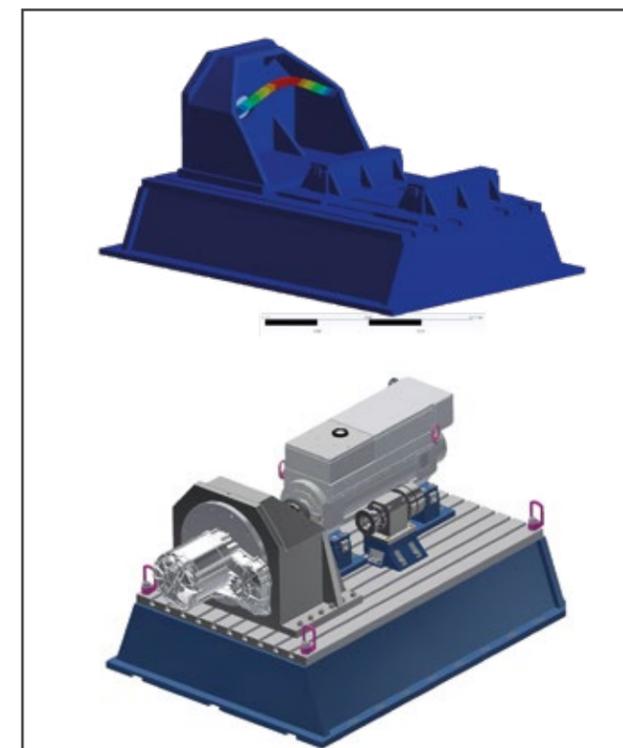
left:  $f_1 = 180,98 \text{ Hz}$ ,  
right:  $f_2 = 189,55 \text{ Hz}$



**Previous machine base frames**

For conventional powertrain test benches GTSYSTEM applied a welded steel construction as a height-adjustable dyno base frame, which has been proved successfully in the common speed range of combustion engines up to 8.000 rpm on more than 50 test benches operated by electric motors. Due to the increasing demands on powertrain test benches by the first hybrid drive components in transmissions with speed ranges up to 10.000 rpm, GTSYSTEM has optimized the height-adjustable dyno base frame in the area below the drive dynos setting. A welded box profile was applied, which due to its geometric shape led to higher stiffness compared to the previous plate variant. This optimization step on this universally applicable, proven machine base frame, for which a patent application has been granted in Germany for 10 years, led to an extension of the range of application on damped T-slot fields to up to 11.000 rpm. As a result of this expansion, the machine base frame continues to be a sought-after solution, which is still being used for our new projects.

Since electric motors with speeds beyond 10.000 rpm are used almost exclusively in electric car drives today because of their efficiency, better power-to-weight ratio and lower costs, completely new solutions had to be developed.



**Non-height-adjustable machine base frame up to 18.000 rpm**

When developing a machine base frame for high speed applications, the height-adjustment function was initially abandoned in order to find a rapidly feasible solution. In cooperation with the company framag, a steel construction filled with polymer concrete with a fixed machine axis height was developed. The preceding FE-calculation showed with 327 Hz as first order natural frequency a usable operating range up to above 18.000 rpm. This non-height-adjustable machine base frame is successfully used on all GETEC and GTSYSTEM test benches worldwide, not least because of its high flexibility.



Fig. 6 | Machine base frame with fixed axis height for applications up to 18.000 min<sup>-1</sup>

## New development of a height-adjustable polymer concrete machine base frame for high-speed test stand applications up to 25.000 rpm

The new height-adjustable machine base should meet the following requirements:

- Suitable for transversal and longitudinal drive train configurations;
- Height-adjustable to compensate different height distances between the device under tests input and output;
- Suitable for high-speed applications up to 25.000 rpm;
- Suitable for both, electric vehicle drives and conventional drive trains;
- Combination of polymer concrete and steel with high stiffness and high damping;
- The machine base frame should offer the possibility to isolate the drive unit with an acoustic capsulation for NVH applications.

With the newly developed, height-adjustable machine base frame, the drive unit including the device under test is still clamped on a welded construction with high stiffness. The guiding frame of the machine base frame is realized as a shear bond of damping polymer concrete and welded construction in connection with a solid base plate. The overall construction assembly gains in stiffness through increased number of joints.

The result of the modal analysis shows a first natural frequency at 418 Hz. This first-order natural frequency corresponds to a speed above 25.000 rpm. A first prototype was manufactured and is currently being tested. Measurements show corresponding results to the calculations. The design, including the concept of the material combination, has been registered for patent in Europe and China since 2018.



With the new machine base frame the device under test is still clamped on a welded construction with high stiffness.



Fig. 7 | Model of the new height-adjustable machine base for EV applications up to 25.000 rpm

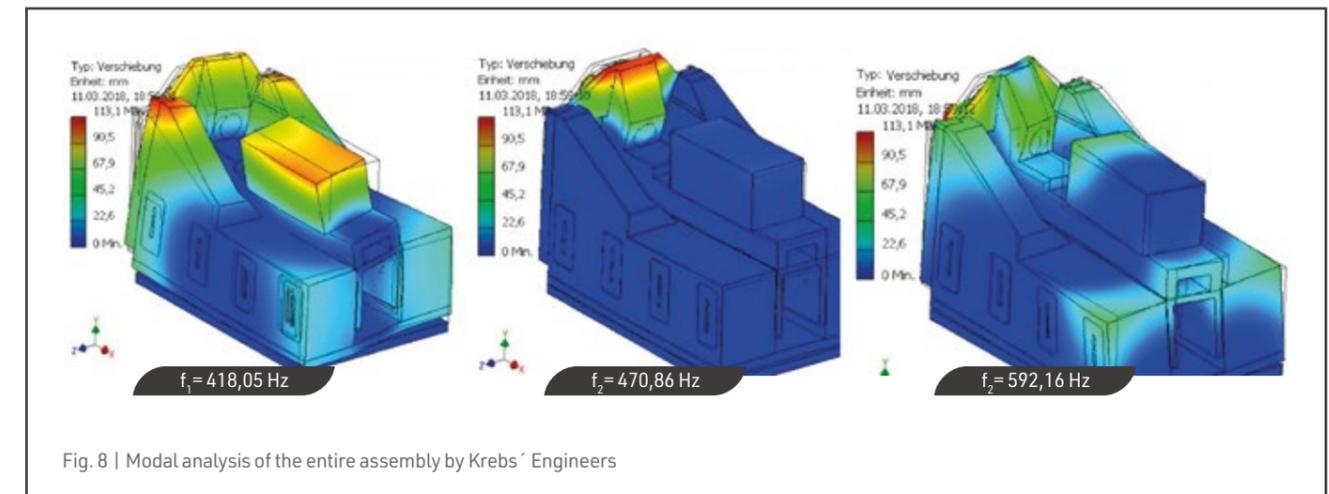
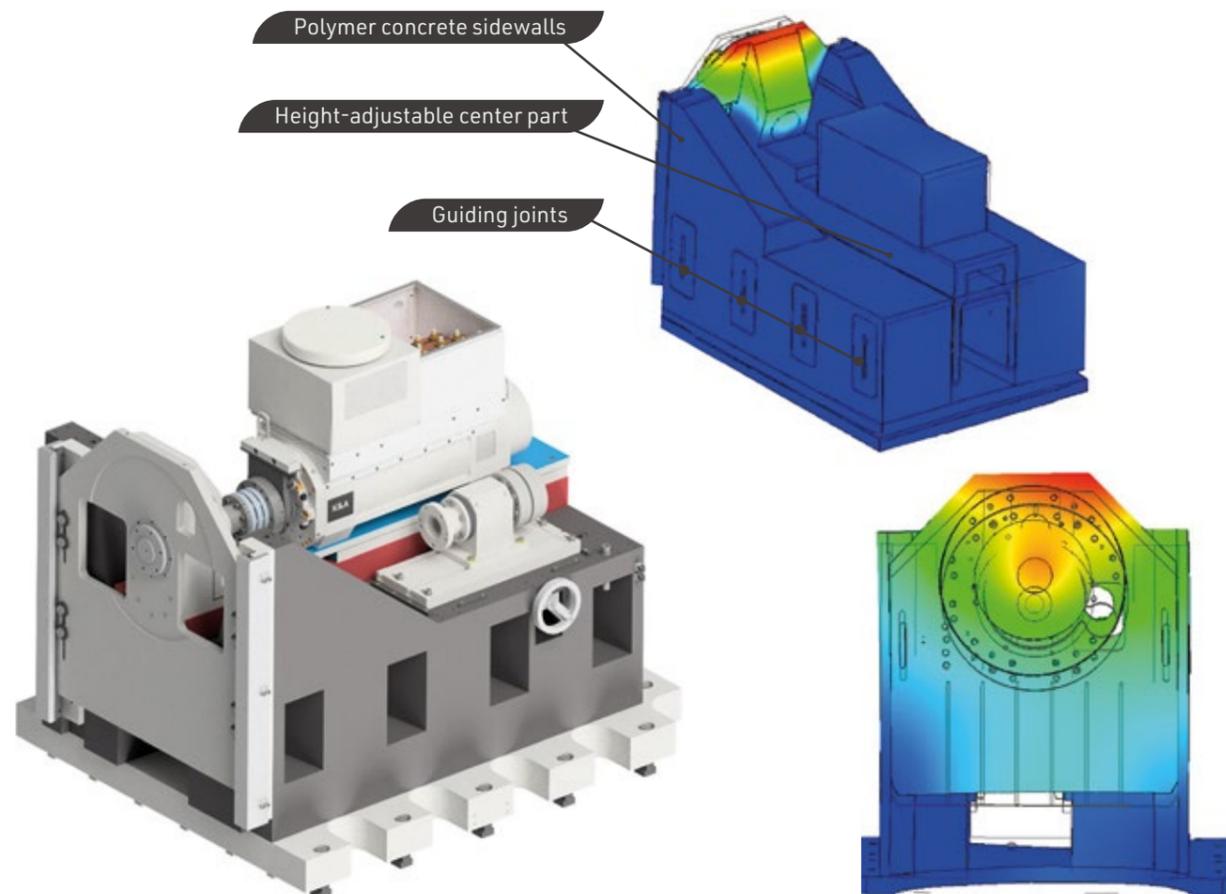


Fig. 8 | Modal analysis of the entire assembly by Krebs' Engineers

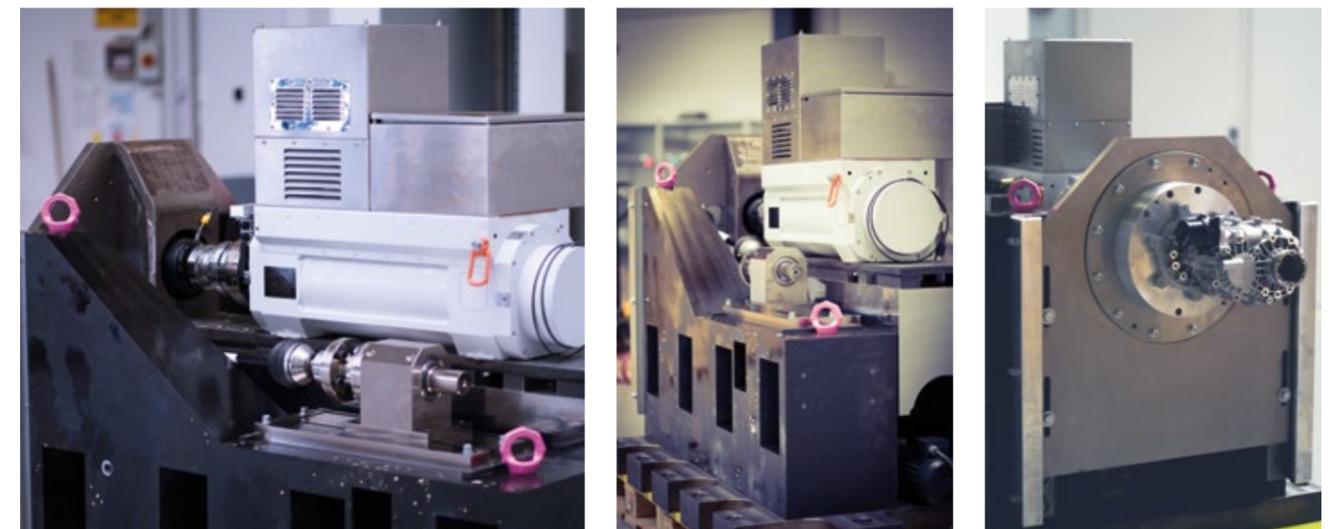


Fig. 9 | First prototype with Electro-Motor by Krebs&Aulich

## IMPLEMENT THE MOST STRINGENT AUTOMOTIVE CARBON EMISSION STANDARDS A Surge of Europe's Electric Car Sales in July 2020

Source: Sina Tech

Recently, according to data released by European countries, the sales of new energy vehicles in eight major European countries, including Germany, France, and the United Kingdom, exceeded 99,500 units in July, a year-on-year increase of 214 %. Among them, sales in Germany, France, and the United Kingdom were respectively 35,900 vehicles, 17,000 vehicles and 15,600 vehicles, an increase of 289 %, 298 % and 286 % year-on-year.

The market view generally believes that the growth of new energy vehicles in Europe – against the trend – is mainly due to the EU's implementation of the most stringent automobile carbon emission standards in 2020, setting passenger car carbon emissions temporary target in 2021, 2025 and 2030 to reach 95 g/km, 80.8 g/km and 59.4 g/km.

Among them, 2020 is a transitional period, 95% of new cars need to meet the carbon emission requirement of 95 g/km, and after 2021, 100% must meet the requirement. For car companies that exceed carbon emission standards, a fine of 95 EUR/g is imposed for each excess part of the car, in an attempt to restrict the production of car companies. At the same time, European countries are also continuing to promulgate policies, adding new incentive policies for new energy vehicles on the basis of the original policies, including reductions and exemptions of purchase tax, registration tax, ownership tax, corporate tax and other subsidies. Essence Securities pointed out that the annual sales of new energy vehicles in Europe is expected to exceed 1 million.

## AUTOMOBILE AND POWERTRAIN TRENDS AFTER THE COVID-19

Source: GTS

How the global auto market develops under the epidemic is still unknown. But what is certain is that the trend of the automobile industry to the new four modernizations has accelerated under the epidemic.

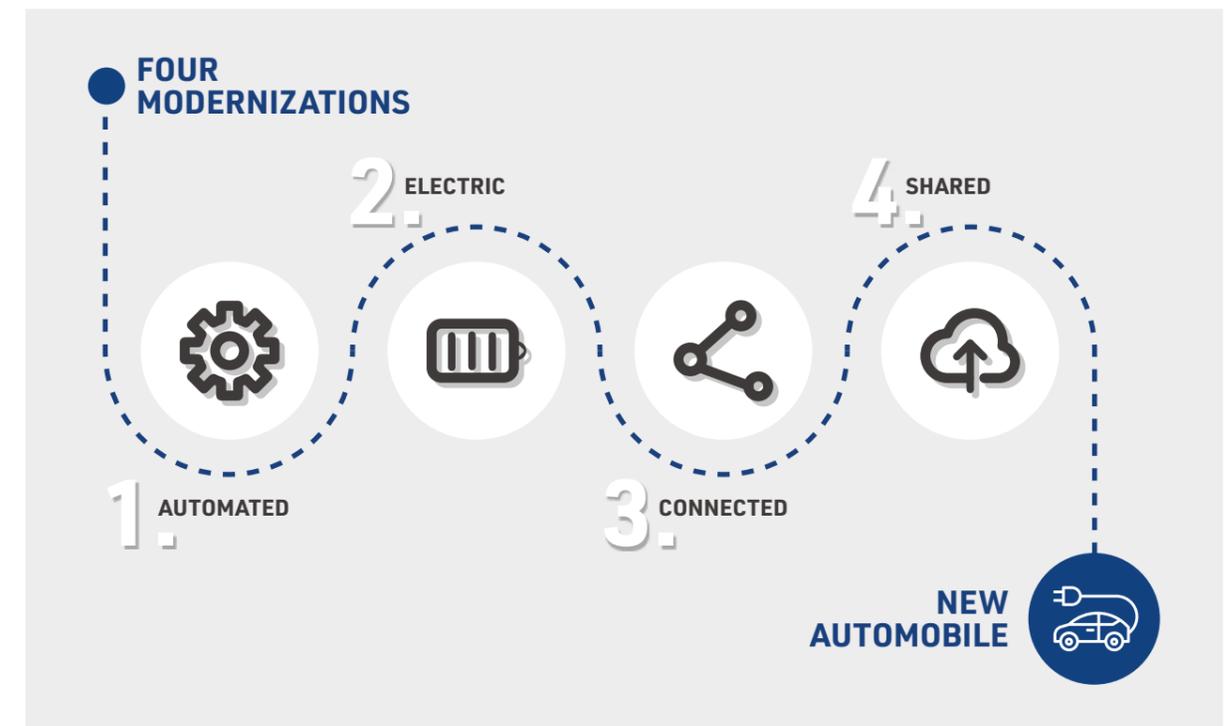
In June alone, Amazon, Didi, Intel, Daimler and other large companies announced major progress in autonomous driving; BYD's blade batteries and Ningde era long-life batteries also received a lot of attention during the epidemic.

### New automobile four modernizations

Due to the impact of the epidemic on group activities, the cluster living mode of metropolitan agglomeration has been impacted; in terms of travel methods, private travel methods that can avoid contact with each other have become more important. This crisis will profoundly change the original public living habits, not only affecting the original related economic model, but also posing a huge challenge to the sharing economy. The society needs a new type of

sharing economy model with more health protection. The new relationship between cars and smart cities (4S means smart cars, smart transportation, smart energy and smart cities) are intertwined.

Contactless Mobility (mobile travel), digitalization, remote services, and control will become the focus of the industry. The development of electrification will be affected in the short-term, but the longterm development is indisputable. The critical point of digital transformation of auto companies is coming ahead of schedule. The core is based on the digitalization of product development, manufacturing, supply chain management, marketing, after-sales service and other links to form a complete closed-loop system connected end to end. This will be a remote, wireless, and contactless digital enterprise operating system that can significantly improve operating efficiency and reduce operating costs.



## HOTSPOTS IN ASIA

1. BYD and Hino Automobile Co., Ltd. signed a strategic business alliance agreement, focusing on the cooperative development of pure electric commercial vehicles (BEVs). Fully combining the technical and experience advantages of the two parties in the field of pure electric commercial vehicles, deep cooperation in retail and other related businesses is carried out to promote the popularity of pure electric commercial vehicles. Source: CPCA

2. FAW Car signed a strategic cooperation agreement with LEAPMOTOR, and will cooperate in the development, manufacturing and production of key components of smart electric vehicles, and conduct in-depth cooperation in the fields of key basic technology development and production model innovation. Source: AUTOHOME

3. The recommended national standard GB/T „Safety Requirements for Electric Vehicle Replacement“, which was drafted by BAIC New Energy, Weilai, and China Automotive Center, has passed the review. According to the standards, by analyzing the differences in different technical solutions, actual vehicle operating scenarios and operating data, it ensures the safety of users when changing power during the vehicle's design life. Source: NETEASE

4. The Ministry of Finance of China issued the „Report on the Implementation of China's Fiscal Policy in the First Half of 2020“. The report mentions support for the development of new energy vehicles and the continuous increase in the

development of new energy vehicles. It mentions support for the development of new energy vehicles, and the relevant departments have clearly extended the purchase subsidy policy. By the end of 2022, at the same time, the intensity and pace of subsidy decline will be smoothed, and policy support for the development of new energy vehicles will continue. Source: SIAN

5. In the first half of 2020, China's auto export volume was 385,600, a year-on-year decrease of 20.94 %. The export of passenger vehicles was 288,600, a year-on-year decrease of 12.05 %, and the export of commercial vehicles was 97,000, a year-on-year decrease of 39.22 %. The annual auto export volume is expected to drop by about 15 % compared with the previous year. Source: sohu

6. At the Chengdu Auto Show in 2020, Dongfeng Citroen will launch a PHEV version of AIRCROSS. It is the world's first plug-in hybrid vehicle equipped with three motors. The new car is innovatively equipped with a „three-engine four-wheel drive“ structure. It consists of a 1.6T PHEV exclusive high-power engine and front and rear dual motors. The combined maximum power is 221 kW and the combined maximum torque of 520 Nm.

7. Kia announced the use of wire-controlled clutch technology for light-hybrid vehicles that can reduce carbon dioxide emissions by 3 %. This technology makes it possible to use traditional manual gearboxes equipped with light mixing

and start-stop systems. Kia modified the traditional hydraulic system used to drive the clutch of a manual vehicle. The clutch of this type of vehicle is directly connected to the car's clutch pedal, while Kia's Intelligent Manual Transmission (iMT) places a module between the pedal and the hydraulic system. Source: Yonhap

8. Yonhap News Agency stated that 10 hydrogen fuel cell heavy trucks jointly built by the South Korean government and Hyundai Motor were exported to Switzerland for the first time on the same day. Hyundai also plans to continue to export 1,600 hydrogen energy heavy trucks to Switzerland by 2025. The hydrogen heavy truck exported this time is 34 tons (including trailers), matched with a 190 kW hydrogen fuel cell system, 350 kW motor, and adopts the newly developed hydrogen fuel cell cooling system and its control technology. It can travel 400 kilometers on a single charge. Source: Yonhap

9. BMW officially announced the „Alibaba Cloud Innovation Center-BMW Startup Garage Joint Innovation Base“ co-founded with Alibaba. BMW and Alibaba will share their respective superior resources and form a strategic alliance to create an innovation incubation ecosystem in the „Internet + automotive“ field. Source: Pcauto

10. With the strong market performance in China, Tesla's strategy in China is also changing. Tesla China's user data and authentication services will be migrated from the United States to China, that is, the server will be moved to China to solve problems such as unstable connection of Tesla App. Source: Gasgoo

# COMING EVENTS

## 2020 TESTING EXPO SHANGHAI | CHINA

**Time:** 14-16.09.2020

**Booth:** 3018

### Testing Expo

CHINA 2020  
AUTOMOTIVE

<https://www.testing-expo.com/china/en>

## 12TH E-MOTIVE BY FVA EXPERT FORUM FOR ELECTRIC VEHICLE DRIVE

GTSsystem is the sponsor of the forum

**Time:** 15-17.09.2020

### E-MOTIVE

by FVA

<https://e-motive.net/en>

## 2020 SBI TEST FACILITY FORUM

New development of height adjustable polymer concrete frame for high speed test bench applications up to 25.000 rpm

**Time:** 22-23.09.2020 | Frankenthal

**Speaker:** GTS | Dirk Horsch

**Speech:** 22.09.2020 | 14:00 - 14:30

### Test Facility FORUM

<http://www.testfacilityforum.de>

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### Commission Center

Wujiang, China

### Sales Office

Seoul, South Korea

### Sales Office

Nagoya, Japan