

tools. Vacoflux 48 is used for stator applications where high mechanical strength is not required. It offers the best soft magnetic properties of all CoFe alloys, comprising ultra-low coercivity of only 35A/m and ultra-high induction at low field strengths (2.24T at 1.6kA/m compared to 1.35T for electrical steel). The potential of such a stator system was successfully demonstrated in a Porsche 911 GT3 R Hybrid during the Nürburgring 24h in 2011.

The Vacodur range of alloys is in the same family of CoFe alloys as Vacoflux 48. With high saturation magnetization and outstanding tensile properties (yield strength up to 800MPa), these materials are extremely useful for rotor applications, particularly in high-speed and/or high-torque motors.

In addition to producing advanced soft magnetic alloys, VAC also manufactures high energy-density, rare-earth-based permanent magnets of samarium cobalt (Vacomax) and neodymium iron boron (Vacodym). Outstanding corrosion resistance is achieved by the use of in-house custom-coating techniques (Vaccoat).

As for the core stacks of the soft magnetic materials, eddy currents in permanent magnets must also be minimized to avoid compromising dynamic behavior and the undesirable generation of heat. To achieve this, the magnets are segmented into very small blocks and glued together using thin insulation layers. Depending on the core geometry involved, VAC has succeeded in producing segments smaller than 1mm with insulating adhesive layers of a mere 50µm.

As a further option, complete magnetic systems can be produced. This is particularly useful when permanent magnets need to be assembled and secured into rotors using adhesives. <

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PERFORMANCE MAGNETICS

Magnetics specialist **Vacuumschmelze** says it can enhance electric and hybrid powertrains in motorsport using high-performance magnetic materials

» Since their introduction to motorsport in 2009, electric powertrain components and generator systems have undergone substantial improvements.

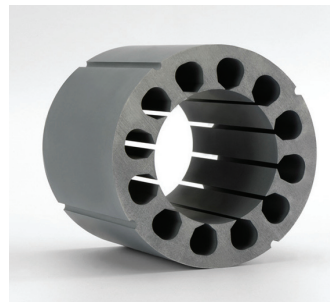
To maximize power density, electric motors and generators require soft magnetic materials with the highest saturation induction and permanent magnetic systems comprising rare-earth permanent magnets.

These requirements are fulfilled by the materials produced by Vacuumschmelze (VAC) in Hanau, Germany. The company also has the necessary technologies in place for processing these materials into components before their installation into the finished motors and generators.

The CoFe alloys Vacoflux and Vacodur are examples of these advanced soft magnetic materials. With a saturation magnetization of 2.3T – significantly higher than conventional electrical steel – they can be used in

VAC produces soft magnetic materials. Its Vacoflux alloy for stator applications (below), was successfully used in a Porsche 911 GT3 R (above)

“A SPECIAL PRODUCTION TECHNOLOGY KNOWN AS VACSTACK HAS BEEN DEVELOPED TO PRODUCE CORE STACKS WITH THE VERY BEST PROPERTIES”



electric motors and generators to maximize the energy density. The manufacture of the core stacks for electric powertrains requires special care to preserve the outstanding properties of the materials. A special production technology known as Vacostack has been developed to produce core stacks with the very best properties. As an effective method of suppressing eddy current losses, ultra-thin tapes 50 or 100µm thick are used to achieve exceptionally high packing densities (typically 98%), with outstanding insulation between the individual layers.

Stator and rotor geometries are manufactured using EDM wire-cutting: this process enables extremely tight geometric tolerances to be achieved and eliminates the need for reworking, which can impair the magnetic properties. EDM wire-cutting is also a very fast and flexible process with respect to design changes as it does not require the manufacture of complex



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