Optimising performance

Materials company VACUUMSCHMELZE GmbH & Co. KG (VAC) is playing an important role in the Formula Student Electric championship by supplying three teams with stator and rotor stacks made of cobalt-iron alloys VACOFLUX® and VACODUR® for their performance-optimised electric motors.

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

These requirements are fulfilled by the materials produced by VACUUMSCHMELZE GmbH & Co. KG (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.

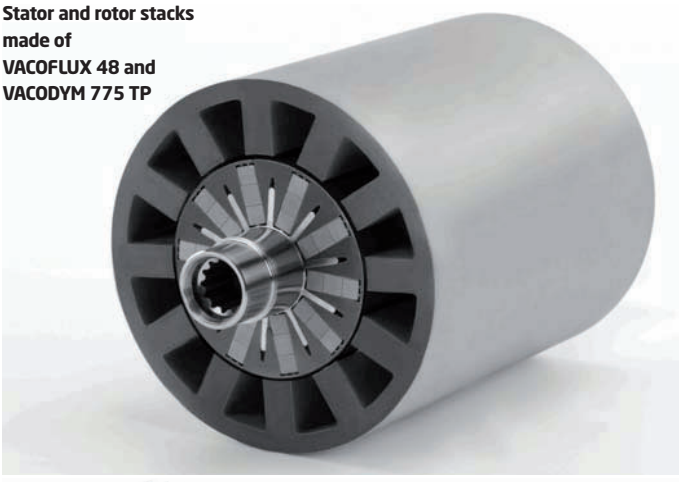
The CoFe alloys VACOFLUX and VACODUR are examples of these advanced soft magnetic materials. With a saturation magnetisation of 2.3 T, significantly higher than conventional electrical steel, they can be used in electric motors and generators to maximise the energy density. Manufacture of the core stacks for electric powertrains requires special care to preserve the outstanding properties of the materials.

A special production technology, known as VACSTACK® has been developed to produce core stacks with the very best properties. As an effective method of suppressing eddy current losses, ultra-thin tapes, no more than 50 or 100 µm thick, are used to achieve exceptionally high packing densities, typically 98%, with outstanding insulation between the individual tape layers.

Using VACSTACK technology, VAC is sponsoring the Swiss AMZ racing team (ETH Zurich) with stacks made of VACOFLUX 48. The rotor stacks are assembled together with in-house produced rare-earth based permanent magnets VACODYM® 776 TP. The resulting components have been built into four motors for the 2013 all-wheel drive race car "julier". Each motor – developed and built by AMZ racing team – produces a maximum power of 37 kW for a weight of only 4.6 kg.

AMZ racing team: race car "julier"

Stator and rotor stacks made of VACOFLUX 48 and VACODYM 775 TP



AMZ motor for race car "julier"

An alternative way to produce such lamination stacks is by using interlocking technology. In partnership with AMK Kirchheim, VAC has supplied stator laminations stamped from the newly developed alloy VACODUR 49 for their AMK DT5-series. These motors have been used by the DUT racing team (TU Delft, Netherlands) and Greenteam (University of Stuttgart, Germany) in their four-wheel drive systems. Comparable to the AMZ motor, extremely high power densities of greater than 7 kW/kg have also been achieved.

This year, the three teams sponsored by VAC participated in the most important events at Silverstone (UK), Hockenheim (Germany), Spielberg (Austria) and Varano (Italy). At Silverstone and Spielberg, the electric cars started together with the combustion engine cars in one single competition. In both cases, the AMZ racing team achieved first place (overall winner). At Silverstone, it was the first time in the history of Formula Student that an electric powered car had beaten the best combustion car. At Hockenheim and Varano, there were separate classifications for the two drivetrain systems. The competition for the electric cars in Hockenheim was won by the DUT racing team while Greenteam Stuttgart achieved the first place in Italy.

In addition to the results of the race competitions, two highlights are demonstrated by the outstanding performance of the race cars sponsored by VAC: While the AMZ racing team captured the first place in the world ranking, the Formula Student Electric Dutch team from Delft University improved the world record for acceleration of electric cars from 2.68 s to a fantastic 2.15 s for 0 – 100 km/h.

VAC congratulates all of the sponsored teams for their amazing performance and looks forward to some close and exciting races in 2014. The future of electric racing cars has just begun!

VACUUMSCHMELZE GMBH & CO. KG
GRÜNER WEG 37
D 63450 HANAU / GERMANY
PHONE +49 6181 38 0
FAX +49 6181 38 2645
INFO@VACUUMSCHMELZE.COM
WWW.VACUUMSCHMELZE.COM

VAC SALES USA LLC
2935 DOLPHIN DRIVE
SUITE 102
ELIZABETHTOWN, KY 42701
PHONE +1 270 769 1333
FAX +1 270 765 3118
INFO-USA@VACUUMSCHMELZE.COM

VACUUMSCHMELZE SINGAPORE PTE LTD
1 TAMPINES CENTRAL 5, #06-10/11
CPF TAMPINES BUILDING
SINGAPORE 529508
PHONE +65 6391 2600
FAX +65 6391 2601
VACSINGAPORE@VACUUMSCHMELZE.COM

VACUUMSCHMELZE CHINA MAGNETICS
SHANGHAI SALES OFFICE
ROOM 06, 19F
ZHONGRONG HENGRUI INTERNATIONAL PLAZA
620 ZHANGYANG ROAD, PUDONG DISTRICT
SHANGHAI, PRC 200122
PHONE +86 21 58 31 98 37
FAX +86 21 58 31 99 37
VAC_CHINA@VACUUMSCHMELZE.COM

Reproduced in association with Racecar Engineering

VACUUMSCHMELZE®

ADVANCED MATERIALS – THE KEY TO PROGRESS