

Electric motors fit for racing cars

Think of electric vehicles and you probably picture sluggish hybrid cars -- but University of Oxford engineers are developing electric motors that power the world's fastest sports cars.



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For decades car manufacturers have known a shift towards electric was inevitable, but even state-of-the-art electric motors are considered too heavy given their power output. Now, researchers from the Department of Engineering Science have developed one which is four times smaller and ten percent more efficient than its competitors.

The motor was born when Dr Malcolm McCulloch and his student, Tim Woolmer, were asked by Morgan Motor Company to help engineer the unthinkable: a green sports car. Along the way, the researchers became painfully aware that electric motors were too heavy, weighing upwards of 100 kg.

Electric motors rely on two parts – one fixed, the other free to move – which use magnetic fields and electric currents to make the rotating part spin. Usually the gap between the two parts is along the radius of the central, rotating drum, but that geometry leads to extremely high losses. McCulloch's team knew a system where the moving part acted like a pancake

spinning on top of a pan would be more efficient, but it was too difficult to manufacture. Through the use of new composite materials, though, the team worked out how to create the complex shapes required, turning exotic theory into practice.

The benefits were immediate: they cut electrical losses by 25 percent, in turn reducing the amount of cooling required, which meant the engine could be smaller. Reducing engine size reduced losses further still, and the team found themselves in a virtuous circle where the engine kept improving. The result, known as the yokeless and segmented armature motor, is four times lighter and ten percent more efficient than its competitors.

Unsurprisingly, the design has proven popular. In 2009 the concept was developed into a spinout company called Oxford Yasa Motors, which received £3.4 million in funding to develop the concept into a real product. Since, its motors have been used in sports cars by Delta Motorsport and, in 2012, Drayson Racing created a bespoke sports car which uses four of Yasa's motors to generate 850 bhp.

But it's not all fast-paced motorsport. Already put through their paces using thermal endurance, salt spray and vibration tests which simulate 150,000 miles on the road, the motors look set to power everyday road cars in the near future. And if they're good enough for sports cars, they're certainly good enough for your family hatchback.

'As well as needing fewer parts, the parts that are required can be smaller and lighter and involve fewer tight tolerances. This all comes together to give a significant decrease in weight, cost and complexity, while also improving the reliability.'

Nick Carpenter, Technical Director, Delta Motorsport

www.yasamotors.com/

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