

Assessment of electric vehicle and battery technology

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Over the last 10 years there has been an incredible surge in the demand for advanced battery technologies. Electric vehicles have been leading the charge and the increased push for the electrification of aircraft has gained considerable momentum over the last few years, both nationally and internationally.

In a world increasingly concerned about the impact of human activities on the environment, the growing use of electric vehicles (xEVs) is going to make an important contribution to efforts to reduce greenhouse gases. The European Environment Agency (EEA) reported that

in 2016, road transport was responsible for almost 72% of total greenhouse gas emissions from transport. Current electric vehicles generate between 17-30% fewer emissions than comparable petrol and diesel powered vehicles, so it has been predicted that if 80% of vehicles on the roads by 2050 are xEV's, direct exhaust emissions of NO_x, PM and SO₂ from road transport, will reduce by more than 80% in comparison with 2010 levels.

According to a 2019 report by Markets & Markets Research, the worldwide demand for xEVs will reach 27 million vehicles by the year 2030, up

from just 3 million units in 2019. And the broader deployment of the xEV charging infrastructure, along with new government financial incentives, are likely to drive demand.

Just as rechargeable batteries were the basis for the first EVs almost 150 years ago, innovations in batteries and battery systems are going to be vital in the continued development of new variations of existing lithium-ion battery configurations to extend battery performance and vehicle operating range. Experiments in battery chemistry, like the utilization of silicone rather than graphite to store lithium, or the appliance of solid electrolytes, may increase EVs driving ranges to more than 500 miles. These developments have been the most significant driver of the demand for battery test chambers and equipment.

At every stage of the battery development process, new technologies must be tested rigorously to determine their safety, performance and longevity. One established method of accelerating the testing procedure is to be able to precisely control the testing environment, rapidly cycling the temperature and humidity within a test chamber. Leading environmental chamber supplier Espec, supported by their UK distributor Unitemp Ltd, are playing a critical role in supporting this research at many research institutes, car manufacturers and universities, who's aim is to establish new battery chemistries and manufacturing techniques helping put the UK at the



Photograph courtesy of MAHLE Powertrain Ltd

forefront of this growing technology.

Based at University of Warwick, WMG can boast a facility that is unique in the UK. It includes pilot-scale production equipment that operates in a climate controlled environment. Mark Amor-Segan, Principal Research Engineer at the site's Energy Innovation Centre, said: "The idea is that the manufacturing facility we've got here allows companies in the UK, which are still generating huge amounts of innovation, new chemistries, and new technologies, to perfect their manufacturing techniques on representative manufacturing equipment, making it easier for them to start manufacturing in the UK or enable them to go to Asian and American large cell manufacturing plants with all their know-how locked down."

MAHLE Powertrain is another of the companies at the forefront of accelerating the battery development process, and has consequently recently opened a facility specifically for the testing and development of electrified powertrain battery packs and modules. The aim of this new facility, which is based at the company's Northampton UK headquarters, is to expedite the validation and testing of new battery technologies, parts and assemblies and therefore reduce the time and cost of the development process. Climate-controlled chambers are key to the success of the operation.

While controlling the humidity and temperature of the testing procedures is important, there is no guarantee of how new chemistries or formats might behave, and batteries have the potential to fail should the conditions not be right, or the chemistry ill matched. The standards that govern such testing are formed by European Council for Automotive R&D (EUCAR), and the second most stringent level is EUCAR 6 which means it will tolerate fire, gas venting and what is termed 'energetic release of materials'.

For WMG and MAHLE Powertrain, choosing the right chambers for battery testing was vitally important. First and foremost, tests needed to be reliable and safe but other factors also had to



be considered; the amount of available test space for the given footprint, energy efficiency, as well as the ability to meet Eucar at level 6. Both companies ultimately selected Espec test chambers from Unitemp for their battery cell evaluation projects.

All Espec chambers meet the EUCAR level 6 standard which is reassuring when dealing with new battery chemistries that have unknown and potentially dangerous behaviours when subjected to the 'real-world' type testing simulated in the environmental chambers. Beyond meeting these stringent requirements, the Espec chambers were also selected for the large amount of test space available in relation to the footprint of the machine and their energy efficiency.

The performance of battery cells, modules and packs can now be safely assessed in terms of storage, thermal

characteristics and electrical response under test conditions replicating the on-road and under-the-bonnet experience, as temperatures can be cycled from -40°C up to 100°C and humidity is always tightly and consistently controlled.

Jack Brown, Sales Director of Unitemp, commented "Battery testing is at the forefront of Unitemp's current success. Espec chambers continue to play a critical role in supporting research at MAHLE Powertrain and the University of Warwick. Lancaster University has also recently invested in chambers built to level 6 EUCAR level 6 safety standards." The mission of all these organisations is to fabricate a new generation of batteries which will outperform the existing ones to deliver higher energy density, are cheaper, safer and longer-lasting.

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