UniversityWafer, Inc. Silicon Carbide Increases Electric Vehicle's Performance and Charging Speed

Silicon carbide materials for enhanced electric vehicle performance.

SOUTH BOSTON, MA, UNITED STATES, July 21, 2020 /EINPresswire.com/ -- Tesla has scheduled its Battery Day for late September 2020. We believe that Tesla will announce a new charging technology that will result in faster charging and more efficient inverters using Silicon Carbide (SiC). SiC devices have proved to be more efficient and robust than traditional silicon-based components, but they do cost more.

> Benefits of Silicon Carbide (SiC) over Silicon (Si) Devices in Electric Vehicles (EVs)"
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> *Christian Baker*

To get Electric Vehicles EVs into the mainstream several things will need to become more efficient including increased car efficiency, extended mileage, and faster charging.

Presently, not only is range anxiety an issue with prospective EV owners, supercharging still takes much longer than filling your gas tank. This is a concern especially in areas that have a lack of chargers or for people who live in apartments that don't have easy access to a home charger, for example. To reach parity with the time required to fill up your Internal Combustion Engine (ICE) vehicle at a gas station Silicon Carbide devices will have to be incorporated into the EVs and charging infrastructure.

But why use Silicon Carbide material?
Electric vehicles require inverters to change Direct Current (DC) into Alternating Current (AC). The speed of the charge is limited to the materials used in the charger, the inverter, and other components.

Silicon carbide (SiC) single crystal wafers used in EVs enables massive reduction in power loss. In layman's terms, SiC is nearly ten times more efficient in handling electrical current than traditional silicon. SiC properties can handle 2,500kv/cm while silicon can only handle 300 kv/cm. SiC thermal conductivity is more than 3 times better than silicon 4.9 W/cm.K vs 1.5 W/cm.K.

Also, SiC's bandgap is nearly three times higher than silicon's. Thus, SiC is less likely to suffer from current leakage. Bandgap means the strength of the bond of a material atoms. SiC, is one of the strongest materials on earth. Its bandgap is stronger than Silicon which results in a high electric breakdown field and thermal conductivity. Higher electrical fields means higher voltage for faster charging times. Smaller SiC devices can be fabricated that use the same voltage as Si, but take up less space. The benefit of smaller devices include faster switching for much higher frequency operation. SiC devices of the same size as Si have shown to have 90% lower resistance resulting in much less energy lost as heat.
Since SiC can operate at much higher temperatures than silicon, it requires 30% less energy to cool the system. Silicon carbide EV systems can cut the cost of an EV by thousands of dollars as few and smaller components are required to off-set the higher price of SiC material.
Tesla's supercharges which currently use Silicon in their systems can charge its EVs up to 80% in 30 minutes and a full charge in one hour with a max output of 25kW | 500V.500A.

But if Tesla announces that it will use Silicon Carbide technology, then fully charging your EV will drop from one hour to just 30 minutes, or 15 minutes to charge up 80% of the battery's capacity.

Most people don't fill up their gas vehicles at the station, in steady putting in a quarter and we envision a 5-minute charge 3 times a week to be enough for the average person's daily commute.

Benefits of Silicon Carbide (SiC) over Silicon (Si) Devices in EVs
Proponents of SiC in EVs have shown that Silicon Carbide makes EVs smarter by increasing the power generated by regenerative braking and overall higher performance. Other benefits include.

• faster switching allows for 80% lower power losses over silicon
• longer range
• fast charging
• increased mileage
• Greatly enhanced inverters that are smaller than traditional inverters
• Up to 90% lower power dissipation while operating a vehicle during a typical commute and driving.
• Smaller components with cooling systems size reductions over 85% as the SiC component can operate at higher temperatures while requiring less cooling. Silicon can operate at 175 deg C vs Silicon Carbide's 200 deg C.
• Traction inverters using SiC can be up to 5x smaller than its silicon counterpart.
• Miniaturization of computer components. SiC allows for smaller die size, packages, and boards over 70%.
Silicon Carbide Devices Advantages over Silicon SiC power devices in electric motors allow them to run at higher speeds with higher torque more efficiently than silicon. Other advantages include.

• Smaller Size
• Lower Energy Losses
• Higher Speeds
• Higher Voltages
• Higher Operating Temperatures
• Smarter high voltage power applications

UniversityWafer, Inc. can help researchers find the Silicon Carbide substrates to help them in their quest to electrify the world and save the planet.

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