DETAILED INSIGHTS OF MPGA AND LITHIUM-ION BATTERY

SPECIFICATIONS	Lithium-Ion Battery	MPGA
Material resources	The increasing adoption of electric vehicles (EVs) and the utilization of batteries in various industries have raised concerns about the availability and sourcing of rare metals required for lithium-ion battery production. Metals such as **Lithium, cobalt, manganese, and nickel** play a crucial role in lithium-ion generation, but their concentration in economically viable regions creates a potential imbalance in their availability. Additionally, as the demand for lithium-ion batteries continues to grow, there are concerns about the long-term sustainability of these rare metals. Therefore, it is crucial to explore alternative battery technologies that can operate without excessive reliance on these rare metals and to promote sustainable sourcing practices for the critical materials used in battery manufacturing.	The main component of MPGA, polyglycolic acid, is **a natural ingredient extracted from plant-based fruit oils**, making it an environmentally friendly material. MPGA batteries combine methylated polyglycolic acid, a biodegradable plastic, with organometallic complexes of power material. This technology is not solely based on modifying plastics, but rather on the combination of modified polyglycolic acid and organometallic complexes. As a result, MPGA batteries not only achieve high performance and sustainability but also have a readily available and extensive supply of plant-based materials that can be sourced from any country worldwide.
Safety Issues	Lithium-ion batteries have inherent risks of ignition and heat generation when subjected to extreme temperatures or improper use. The use of organic solvents as electrolytic solutions in these batteries contributes to these risks. While safety measures such as thermal management systems and battery management systems have been implemented, incidents of overheating or catching fire can still occur, particularly under high-stress or abuse conditions. The acceptable temperature region for the Lithium-Ion battery normally is **−20 °C ~ 60 °C**. The critical temperature to trigger “thermal runaway”, a chain reaction that can lead to a fire or catastrophic explosion, is between **126.1 °C and 139.2 °C.** It is essential to handle Lithium-Ion batteries with care, follow recommended safety guidelines, and ensure proper usage, charging, and storage to mitigate these risks.	**No risk of fire:** MPGA batteries offer a reduced risk of fire and explosion compared to Lithium-Ion batteries for several reasons. Firstly, MPGA materials have a higher melting temperature that is in the range of **220-230 °C,** and the battery made by MPGA has a safe performance range of **-20 °C to 85 °C**, making them less prone to thermal runaway. This significantly lowers the risk of fire or explosion.
Environmental protection (Disposal of waste batteries)	The environmental impact of discarded Lithium-ion batteries is a pressing issue that requires attention. To put it into perspective, even a single 20-gram battery from a cell phone has the potential to contaminate the water in three standard swimming pools. **Improper disposal of such batteries on land can lead to contamination of an area as large as one square kilometer for up to 50 years.** This accumulation of discarded batteries poses a significant threat to soil and water pollution, as well as the overall health of ecosystems and human well-being.	**Pollution Free:** MPGA battery is an environmentally friendly material that contributes to pollution prevention. Unlike conventional batteries, MPGA batteries are made from a biodegradable polymer that can be completely degraded into water and carbon dioxide by microorganisms in the soil. This degradation process reduces the risk of pollution from discarded batteries. In contrast, conventional batteries often contain toxic heavy metals and other harmful chemicals that can leach into the environment if not disposed of properly. Therefore, MPGA batteries have a low environmental impact and are considered pollution-free.
Recharging Speed	It can be as little as **30 minutes or more than 12 hours**. This depends on the size of the battery and the speed of the charging point. A typical electric car (60kWh battery) takes just under 8 hours to charge from empty to full with a 7kW charging point. The fastest-charging EVs in 2023 can charge their batteries at speeds of up to 250 kW. This means that they can gain up to 200 miles of range in just 15 minutes.	**Less than 25% of lithium batteries** in the same environment. Currently providing as low as **8 min per charge**.
Recharging Cycles	Most EV batteries have a rating of **1,500 to 2,000** charging cycles. One of the most current technologies in the year 2023 claims an expected cycle rating of 3,000-5,000 full cycles.	**40,000+** cycles **“20 times of Lithium-Ion”**
Battery Life	**5-10 years**	**20+ years**
Charging/Discharging Temperature	Charging: **-10-45℃** Discharging: **-20-60℃**	Charging: **-20-120℃** Discharging: **-20-120℃**
Volumetric energy density	The volumetric energy density of a battery refers to the amount of energy stored per unit volume, and most commercial lithium-ion batteries have a range of **450-600 Wh/L.** This means that a battery with a volume of one liter can store between 450 and 600 watt-hours of energy, depending on its design and chemistry. Factors such as temperature, charge level, and battery age can affect its energy density.	**625 WH/L** under the equal conditions
Weight energy density	Today's lithium-ion batteries have an energy density of an average of **150-300Wh/kg.** In other words, there is 4kg of material per kWh of energy storage.	**428 WH/KG** 2.3kg of material per kWh of energy storage. **Twice less than Lithium battery.**
Weight	**4-7Kg / 1KWh**	**2.3Kg/ 1KWh**
Cruising distance	• Tesla Model 3 Long Range: 657 km (408 mi) • Tesla Model Y Long Range: 614 km (382 mi) • Chevrolet Bolt EV: 418 km (260 mi) • Nissan Leaf Plus: 363 km (226 mi) • Hyundai Kona Electric: 484 km (301 mi)	**Average of 1,400km** (≥ 850 miles)
Raw Refined Material Cost	Average of **$45 per** battery pack based on 23% of the total production cost.	Average **$15** per battery pack under the equal production condition
Price	**$151** per kilowatt-hour (kWh) (November, 2023) • 23% - Raw/ Refined materials • 11% - CAM processing fee, logistics, tariffs • 19% - Other Cell material • 21% - Cell production • 26% Module/Pack production	**Less than $80** Under equal conditions, the manufacturing process of an MPGA battery is less complex compared to a Lithium-Ion battery, accounting for less than 50% of the overall process. Additionally, MPGA batteries have the advantage of lower material costs compared to Lithium-Ion batteries.