Insights Into a Novel Electrostatic Motor Design for Electric Vehicles and Other Applications

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The increasing demand for high-performance electric motors in electric vehicles and modern appliances has intensified the reliance on rare earth metals for permanent magnets. However, concerns regarding many supply chain limitations, environmental impact, and cost fluctuation have driven research into alternative motor technologies. My project explores my novel design of an electrostatic motor that operates using the principle of repulsion and attraction of electrical charge known as Coulomb's Law, instead of a typical motor that works based on magnetic interactions. By eliminating the need for rare earth magnets, Electrostatic motors offer a potentially lighter, more sustainable, and energy-efficient solution. Key factors that were considered included dielectric material selection and optimized electrode design to maximize force generation. While electrostatic motors typically face challenges in torque output and high power operation, advancements in insulation materials used as well as power electronics may enable practical use cases. The motor frame was designed in Fusion 360 and was made to handle various voltages quite effectively. Power was supplied using a lab bench power supply capable of delivering up to 30v 10amps, ensuring a stable power source. A series of testing procedures were conducted to measure the motor's efficiency, torque, rpm, and power output. After 7 prototypes my final design was able to achieve an efficiency of 5.4% greater than that of a permanent magnet motor at 1000 rpm. These findings show that electrostatic motors have the potential to be used in many applications and perform the same if not better than permanent magnet motors.

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