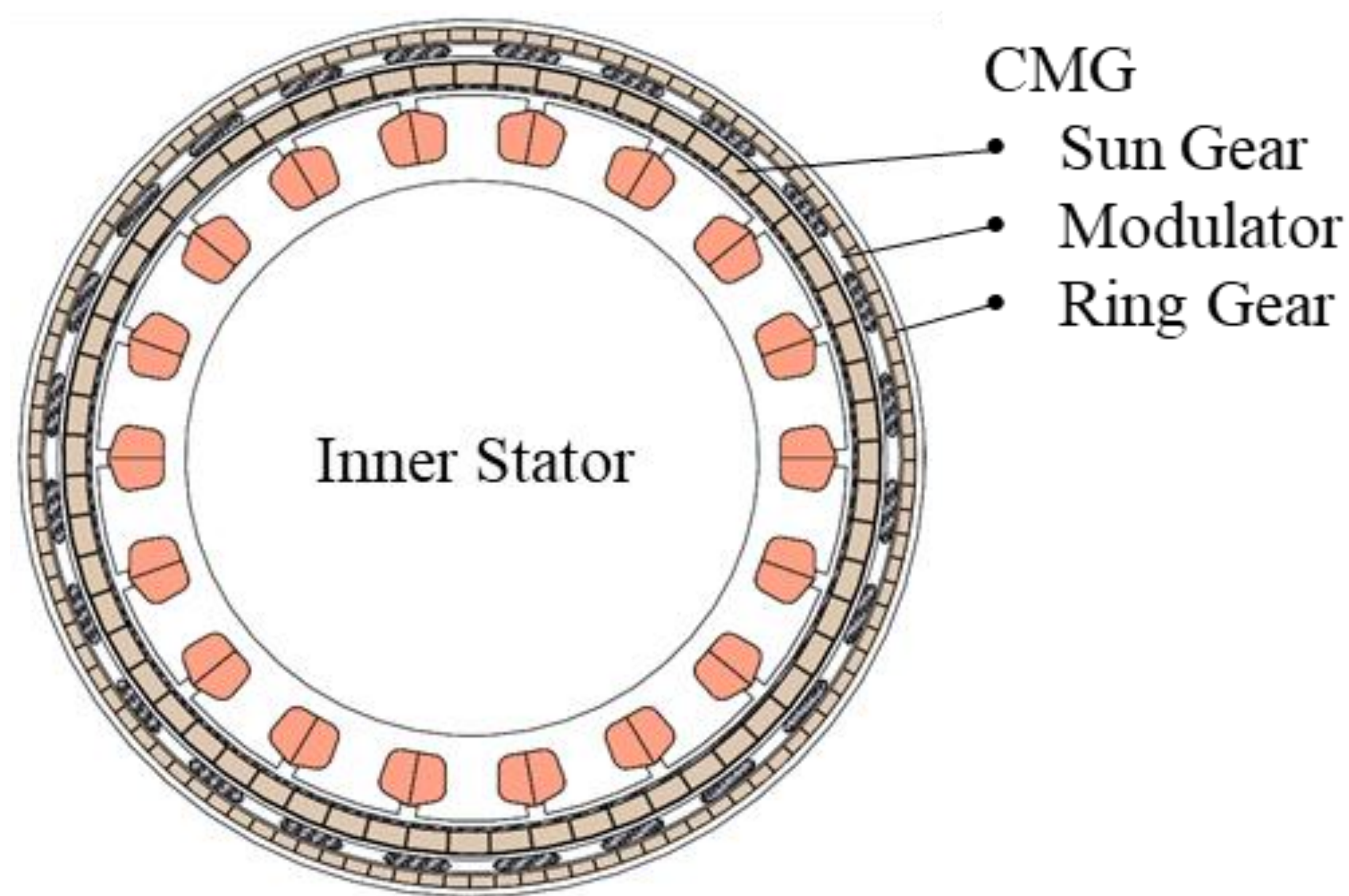


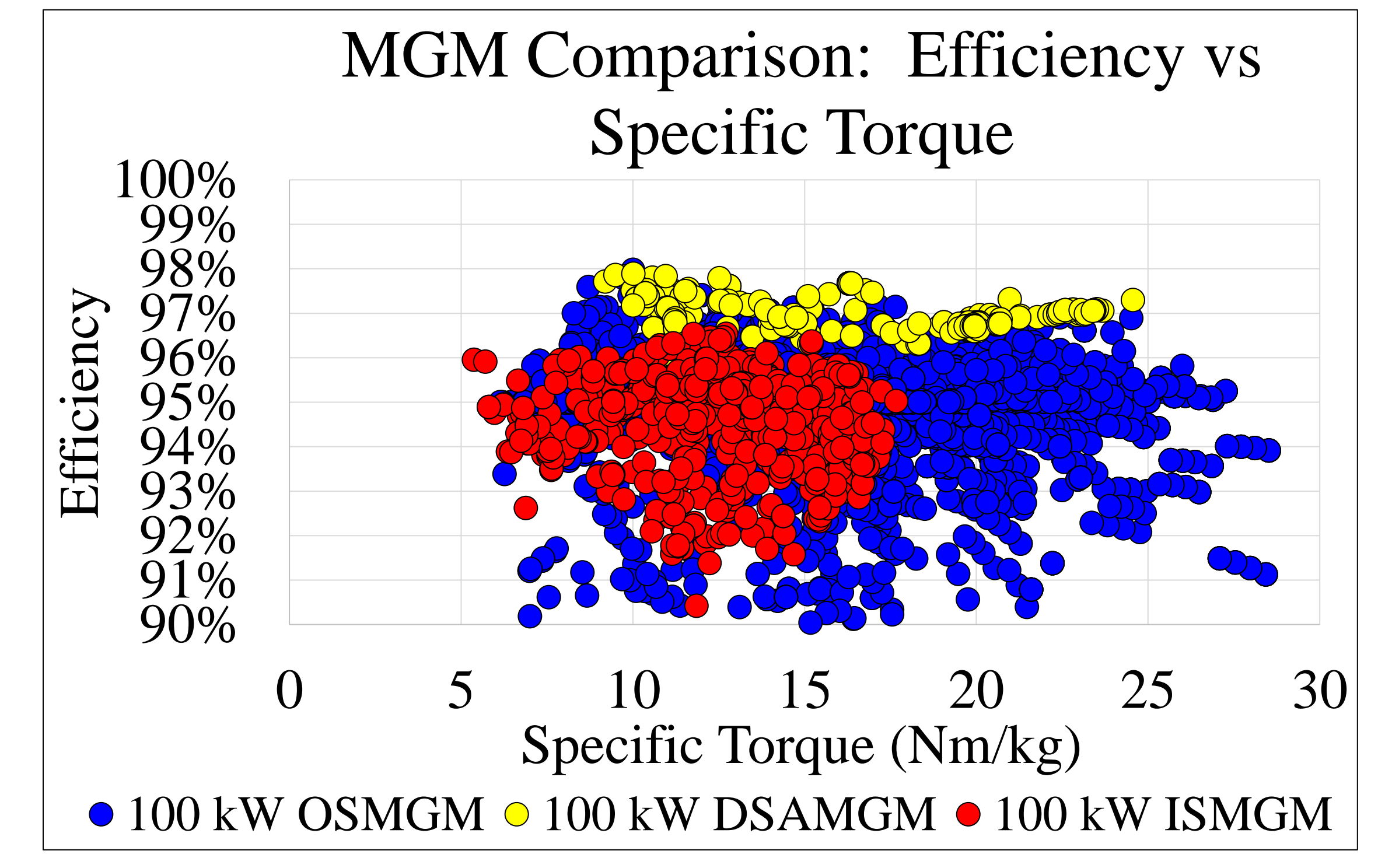
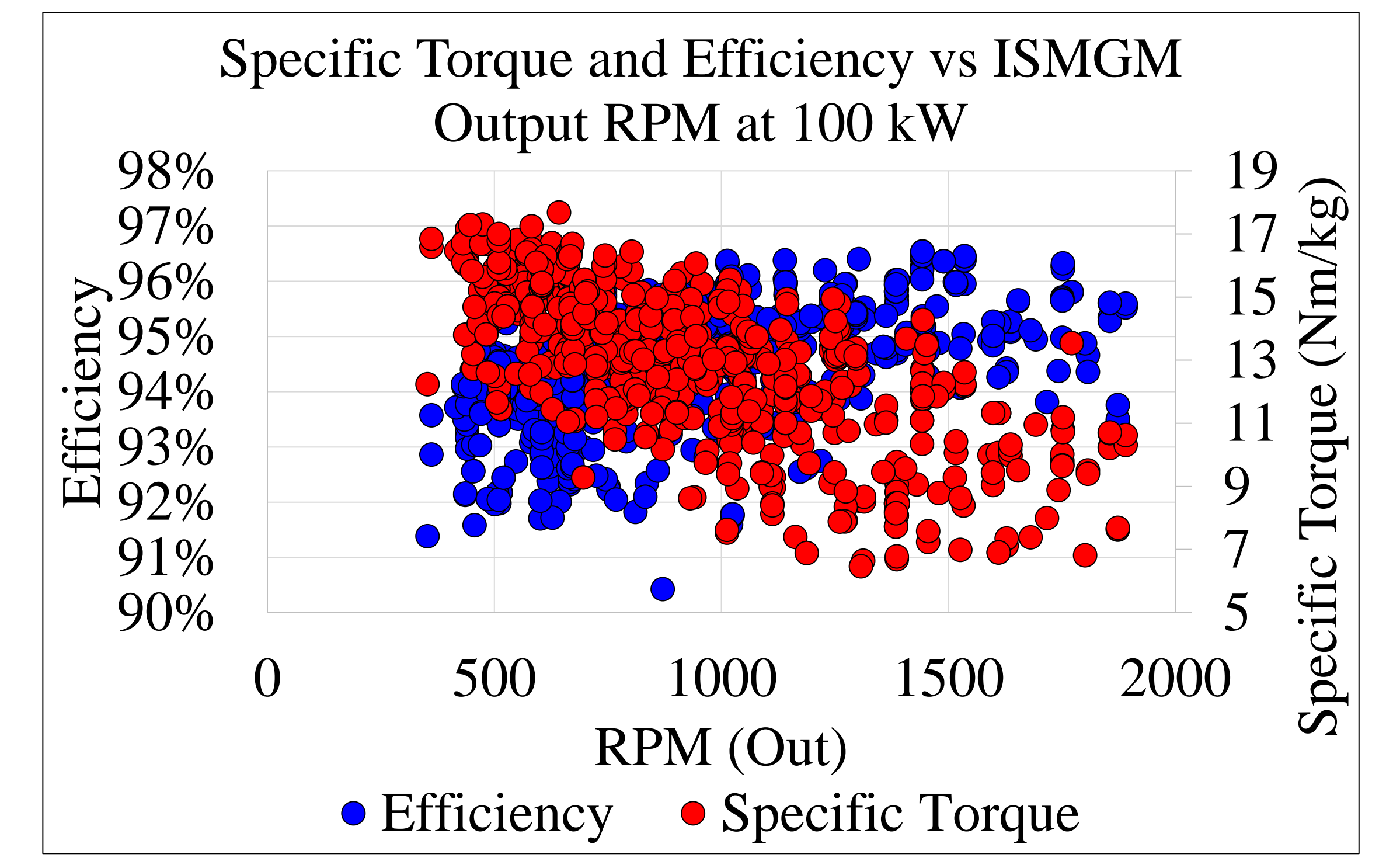
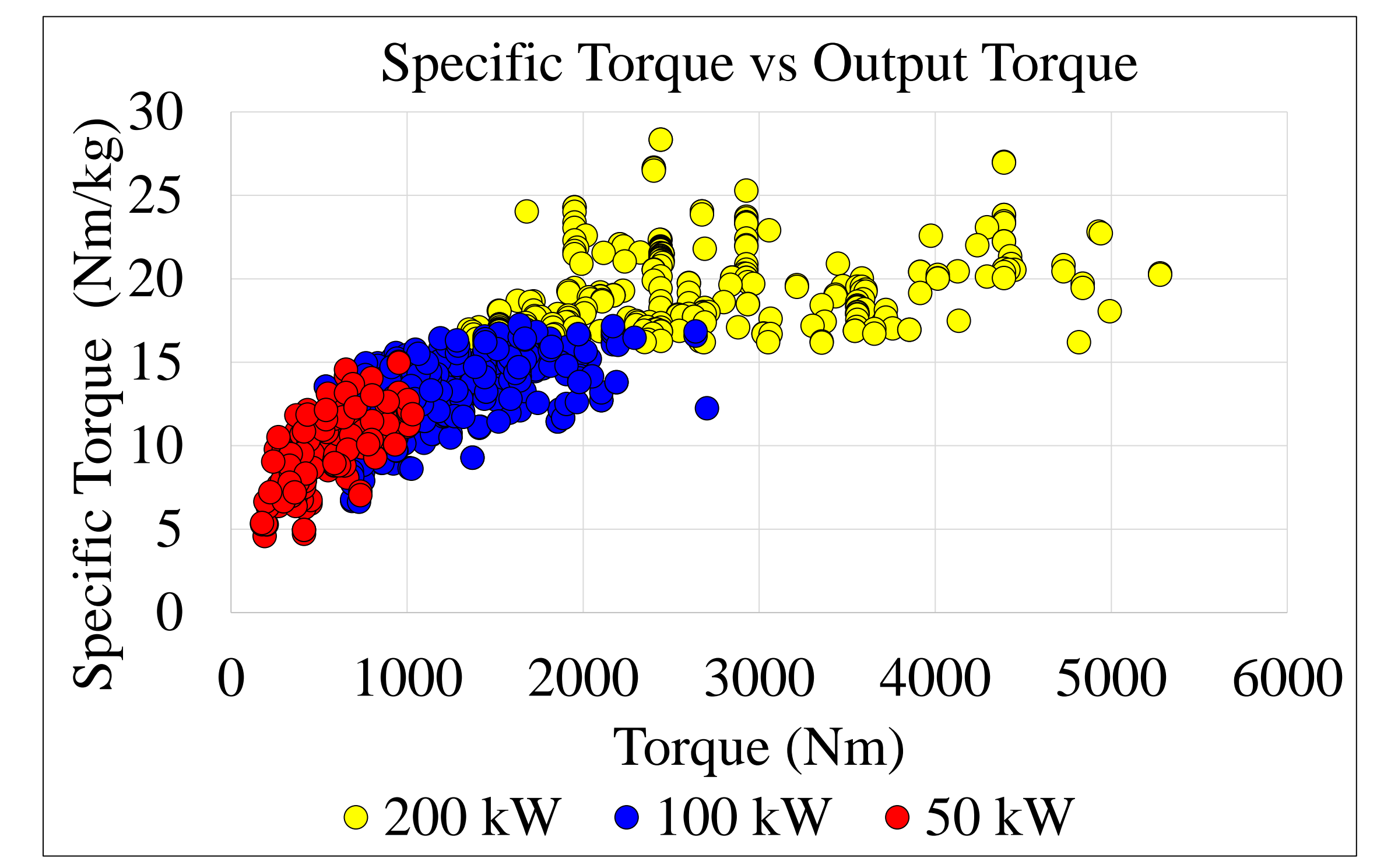
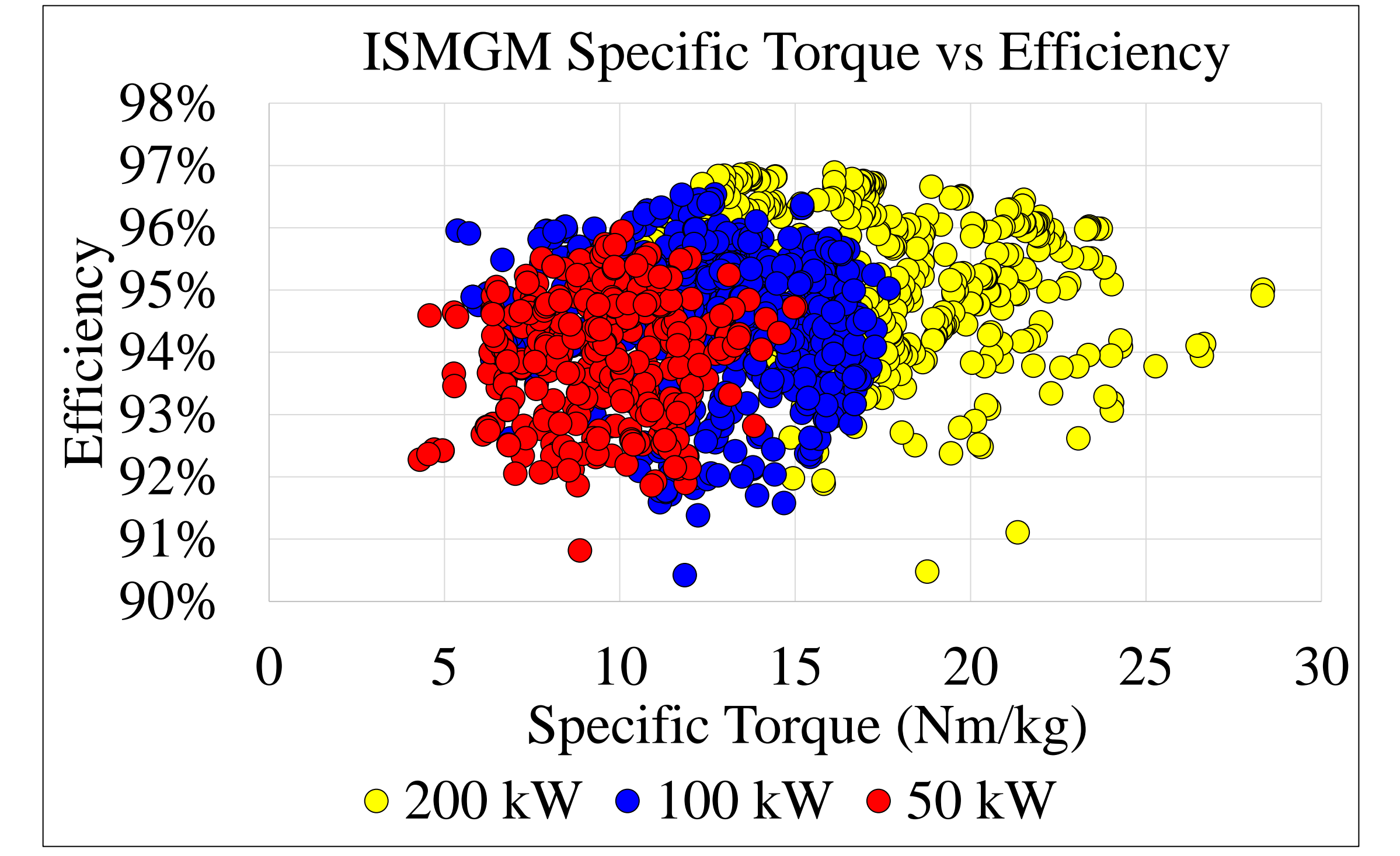
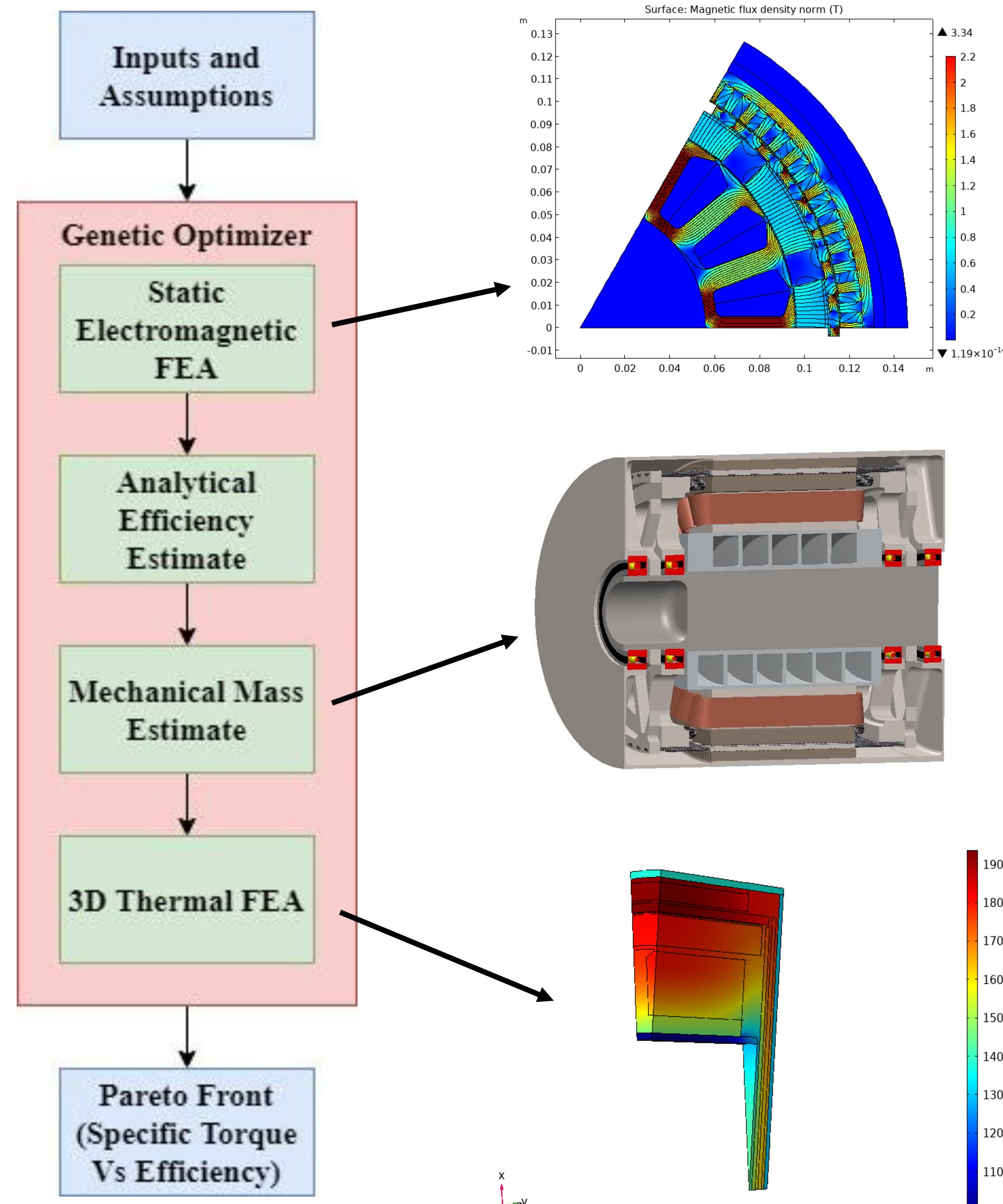
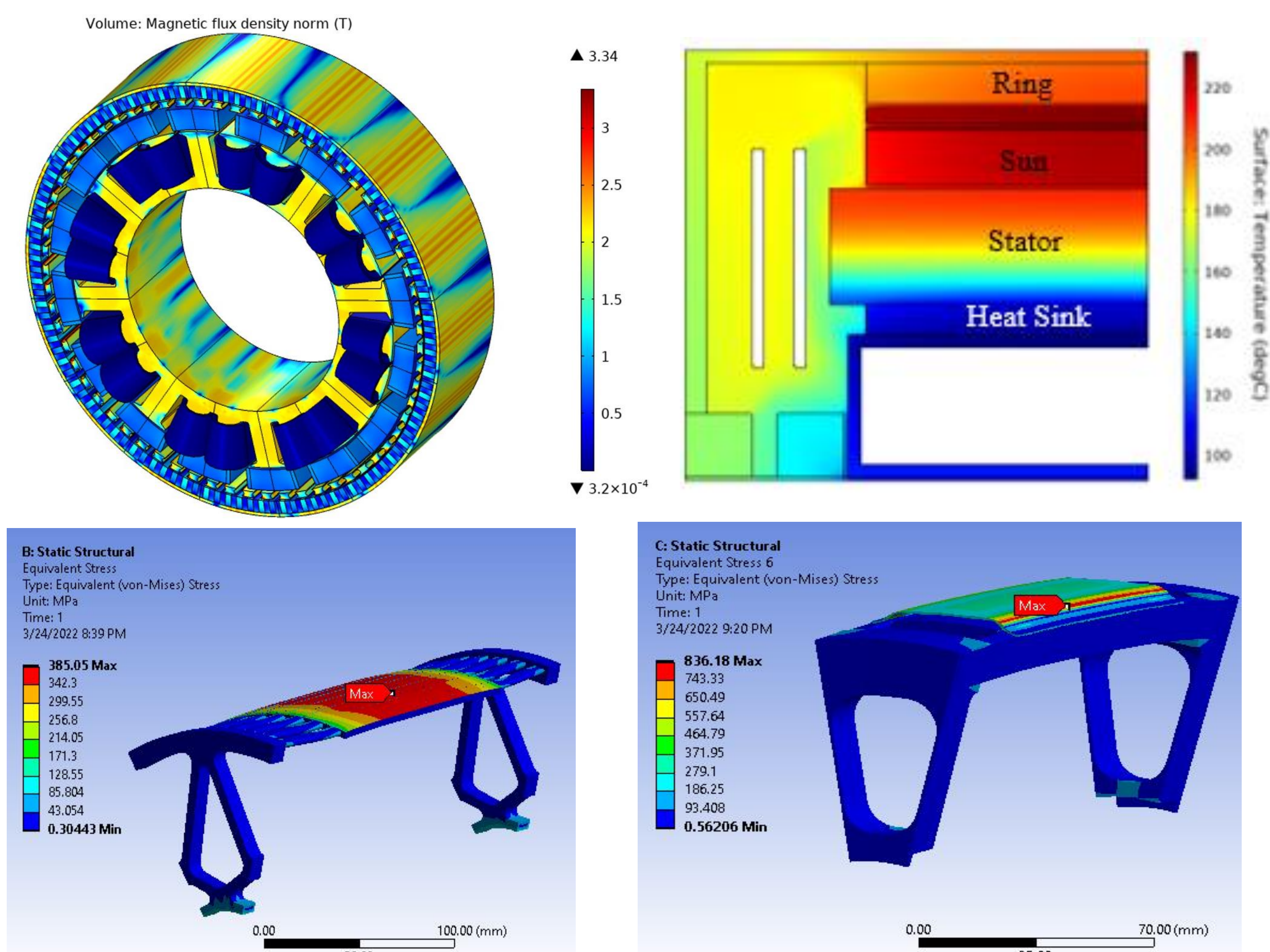
## Abstract

Electrified aircraft require high performance and high reliability electric motor drivetrains. A geared electric motor drivetrain will outperform a direct drive motor drivetrain in most applications. Traditional mechanical gearing, however, has mechanical contact-based wear and failure modes that result in added maintenance costs and require an oil lubrication system. Magnetically geared motor drives are a potential technology for electrified aircraft applications capable of enabling the benefits of a geared drive without the maintenance, reliability, and lubrication system cost of mechanical gears. In this paper, a topology of magnetically geared motor, an inner-stator magnetically geared motor, is explored to estimate its achievable performance for electrified aircraft applications. Optimization results on the topology show that it can achieve greater than 15 Nm/kg specific torque and 96% efficiency at 100 kW of power.

## ISMGM Topology



## High Fidelity Analysis of an Example Design



## Conclusions

- An ISMGM can enable specific torques on par with state-of-the-art high specific torque machines (>10 Nm/kg) at efficiencies greater than 95%.
- Compared to other topologies of MGM explored by the authors, the ISMGM is not able to achieve the same performance as the DSAMGM [2] or the OSMGM [1].
- The ISMGM may still have system level and/or integration benefits relative to the other topologies, because of the ability to use the ring gear as the output of the drive.
- Future work targets a system level comparison of a MGM drive to a mechanically geared drive.

## References

1. T. F. Tallerico, Z. A. Cameron, J. J. Scheidler and H. Haseeb, "Outer Stator Magnetically-Geared Motors for Electrified Urban Air Mobility Vehicles," in *AIAA/IEEE Electric Aircraft Technologies Symposium (EATS)*, Virtual, 2020.
2. T. F. Tallerico, J. J. Scheidler and A. Smith, "Design Study of Double-Sided Axial-Flux Magnetically-Geared Motors for Electric Aircraft Applications," in *AIAA Propulsion and Energy Forum*, Virtual, 2021.