

*Engi-Mat is a privately-owned developer and manufacturer of nano **engineered materials**, with extensive history of innovation in nanotechnology and materials science. Engi-Mat is ISO9001:2015 certified for the design and production of nanopowders. For more information, visit engi-mat.com.*

Engi-Mat's proprietary Marvite™ Materials offer dramatically improved heat dissipation

Lower temperatures • Reduced size & weight • Increased power density • Longer life • Increased efficiency

Testing conducted by National Renewable Energy Laboratory (NREL) and Oak Ridge National Laboratory (ORNL)

Marvite Insulation and Marvite Resin

Engi-Mat's proprietary materials incorporate both conventional polymers/resins and nanomaterials, with outstanding results:

Thermal conductivity (measured by NREL):

- **Marvite wire insulation:** 0.81 W/m·K
- **Marvite resin:** 3.0 W/m·K

Thermal modeling (NREL) indicates >900% increase in effective cross-slot thermal conductivity (20 AWG wire):

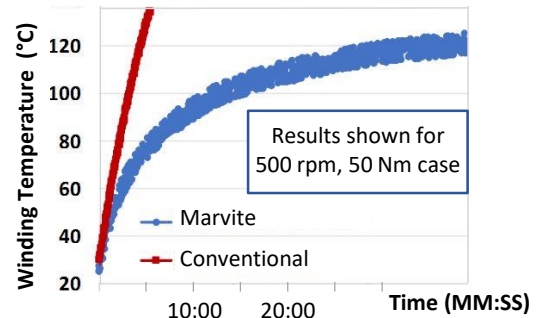
- 5.34 W/m·K with **Marvite insulation and resin**
- 0.52 W/m·K with conventional insulation and resin

- | | | |
|--|-----------------------------|---------------|
| Marvite wire insulation satisfies NEMA MW1000: (using 250°C rating) | • Dielectric strength | • Continuity |
| | • Flexibility and adherence | • Cut-through |
| | • Thermal endurance | • Heat shock |
| | • Scrape resistance | • Spring-back |
| | • Dissipation | • Solubility |

Superior Thermal Performance

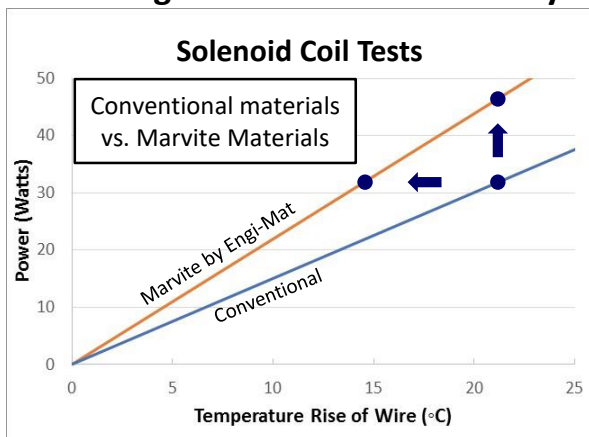
ORNL tested two nearly-identical motors:

- Adapted from the 2010 Toyota Prius
- "Marvite" = with Marvite insulation and resin
- "Conventional" = with conventional materials



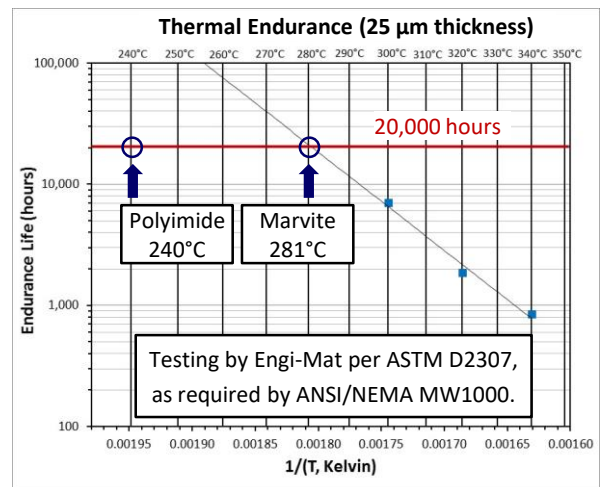
Conventional motor: reaches 130°C in 5:20
Marvite: approaches steady state of ~125°C

Enabling Increased Power Density



Marvite Materials enable 46% more power without increasing wire temperature (or 31% lower temperature rise at same power)

Higher Thermal Index for Extended Endurance



Thermal Index of Marvite wire insulation (281°C) is dramatically higher than polyimide's (240°C)