

# Axial-Flux Motors (AFM)

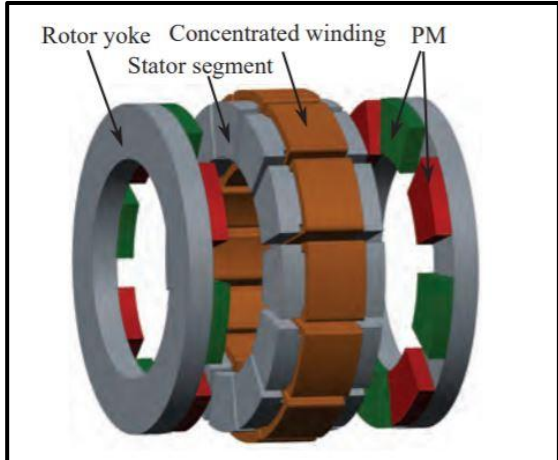
## Current Materials Used

- 1. **Stator segment:**  
95-97% Fe, 1-3% Si (Lamination Steel) or SMCs
- 2. **Rotor yoke:** 304 SS (Ferrite SS)\*
- 3. **PM:** NdFeB

- Featured Properties**
- High torque and powder density
  - Adjustable air gap
  - Low vibration and noise
  - High efficiency and compactness

## Example of a AFM-PM BLDC Design Parameters

Motor type	A
Number of poles	10
Number of slots	<b>15</b>
No-load Voltage , V	50
Rated phase current, A	34
Rated rotational speed, rpm	1200
Stator outer radius, mm	95
Stator inner radius, mm	55
Slot-opening, mm	4
Tooth width at average radius, mm	27.41
pole-arc to pole-pitch ratio	0.7
Air gap, mm	1.5
Magnet axial length, mm	5
Magnet remanence, T	1.22
Number of turns per coil	20
Bar length, mm	32
Filling factor	0.65
Back-iron thickness, mm	10



**Motor Topology: PMAFM with Internal Segmented Armature (PMAFM-ISA)**

# Transverse-Flux Motors (TFM)

## Current Materials Used

- 1. Stator segment:** 95-97% Fe, 1-3% Si (Lamination Steel) or SMCs
- 2. Rotor yoke:** 304 SS (Ferrite SS)\*
- 3. PM:** NdFeB

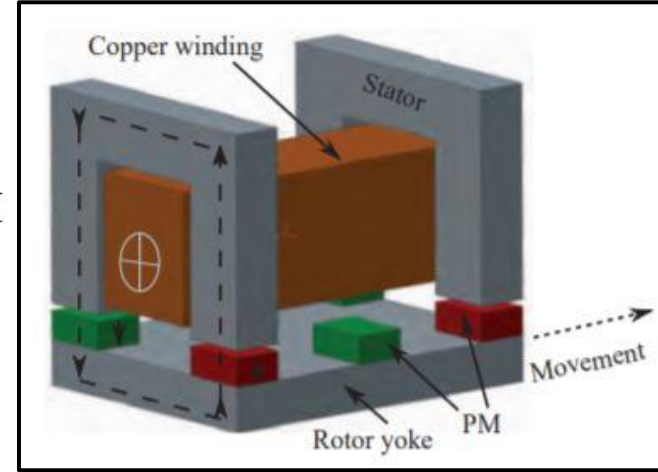
## Featured Properties

- High torque density
- Simple winding structure
- Decoupling of the magnetic and electrical loading
- Large number of poles with a simplified robust design

## Example of a TFM Design Parameters

Table 1: Dimensions and Parameters of the TFM Motor

Dimensions and parameters	Quantities
Rated frequency (Hz)	300
Number of phases	3
Rated power (W)	640
Rated line-neutral voltage (V)	80
Rated phase current (A)	5.5
Rated speed (rev/min)	1800
Rated torque (Nm)	3.4
Rated efficiency (%)	79.5
Rated winding temperature rise (°C)	90
Number of poles	20
Stator core material	SOMALOY™ 500
Stator outer radius (mm)	40
Effective stator axial length (mm)	93
Rotor outer radius (mm)	47
Rotor inner radius (mm)	41
Permanent magnets	NdFeB, Grade N30M
Magnet dimensions	OD88 x ID82 x 9 mm arc 12°
Magnetisation direction	Radial
Main airgap length (mm)	1
Stator shaft	Mild steel
Shaft outer radius (mm)	9.5
Coil window dimension (mm <sup>2</sup> )	15 x 20.5
Number of turns	125
Diameter of copper wire (mm)	1.25



**Motor Topology: PM Excited  
TFM Surface Mounted Single  
Sided**

## \*Actual Material Composition of 304 Stainless Steel (Low Carbon Ferritic Steel)

	Type 304	Type 316
<b>Carbon</b>	0.08% max.	0.08% max.
<b>Manganese</b>	2.00% max.	2.00% max.
<b>Phosphorus</b>	0.045% max.	0.045% max.
<b>Sulfur</b>	0.030% max.	0.030% max.
<b>Silicon</b>	1.00% max.	1.00% max.
<b>Chromium</b>	18.00-20.00	16.00-18.00
<b>Nickel</b>	8.00-10.50%	10.00-14.00
<b>Molybdenum</b>	-	2.00-3.00%

Source:  
<https://www.greenwoodmagnetics.com/resource/what-is-the-difference-between-304-and-316-stainless-steel/>

# Assembly method of PMs on Rotor Yoke

## Magnetic bonding of PMs to Rotors

Adhesives are intrinsic to the structure of electric motors as they are an effective way of securing magnets, shafts, rotors and housings together.

Material: A new methacrylic acid free structural acrylic adhesive which would not corrode sensitive components when inside a sealed motor.

### **Key features:**

Withstand high temperatures, quick cure speeds for high speed electric motors.

Excellent impact resistance.

Does not require a heat cure so helps maintain a better level of magnetism.