

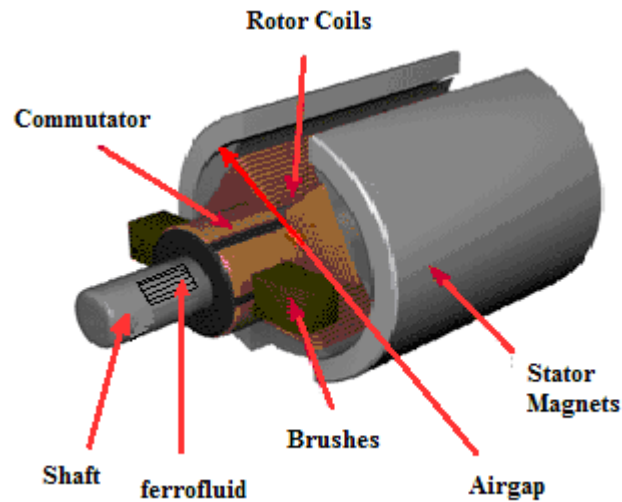
## 5.6 PMDC Motor

We know that a DC motor has an armature which rotates within a magnetic field, and the main working principle of this motor depends on a current carrying conductor which is arranged in a magnetic field, and the mechanical force will be experienced with the conductor. DC motors are classified into different types which work on the same principle. Thus, the DC motor construction can be done by establishing a magnetic field with any kind of magnet like electromagnet otherwise a permanent magnet. A PMDC (Permanent Magnet DC motor) is a kind of DC motor that includes a permanent magnet to form the magnetic field necessary for the DC motor operation. This article discusses an overview of PMDC or Permanent Magnet DC motor.

The permanent magnet dc motor can be defined as a motor which includes a permanent magnet pole is called Permanent Magnet DC Motor. In this motor, the magnet can be used to make the flux working within the air gap in its place of the field winding. The rotor structure is similar to the straight DC Motor. PMDC Motor's rotor includes armature core, commutator, & armature winding. Normally, in a conventional DC motor, there are two kinds of winding such as armature as well as Filed.

The main function of field winding is to produce the functioning magnetic flux within the air gap as well as wound on the stator of the motor while armature winding can be wound on the rotor. Inactive carbon brushes are pushed on the commutator like in conventional DC motor. The operating voltage of the PMDC motor is 6 volts, 12 volts otherwise 24 volts DC supply attained from the voltage sources.

The PMDC motor's permanent magnets are maintained with a cylindrical-steel stator and these supplies like a return lane for the magnetic flux. The rotor supplies like an armature, and it includes commutator segments, winding slots, & brushes like in conventional dc machines. The permanent magnets used in this motor are classified into three namely Alnico magnets, Ceramic (ferrite) magnets, and Rare-earth magnets.



**Figure 5.6.1 Permanent Magnet DC Motor**

[Source: “Electric Machinery Fundamentals” by Stephen J. Chapman, Page: 416]

- Inico magnets are used within motors which have the ratings in the range of 1kW-150kW.
- Ferrite or Ceramic magnets are much cheap within fractional kw (kilowatt) motors.
- Rare-earth magnets are made with samarium cobalt as well as neodymium iron cobalt.

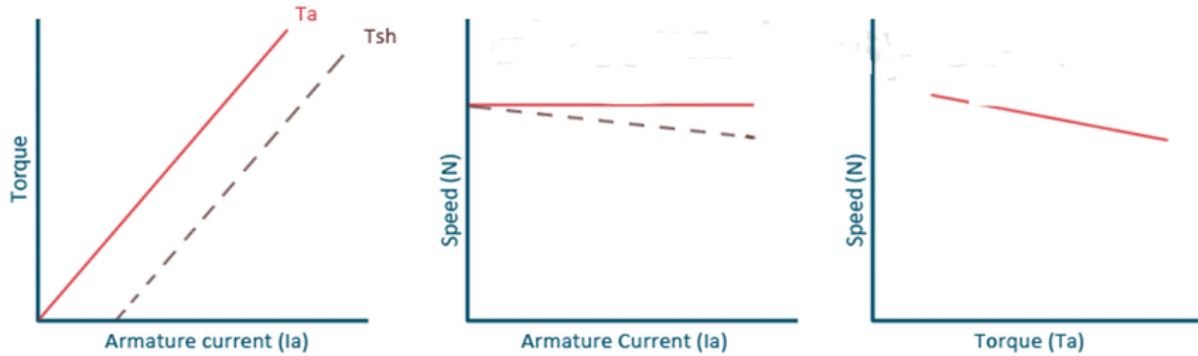
#### **Operation :**

- In this motor, a permanent magnetic field can be generated with the permanent magnets communicate by the perpendicular field stimulated by the flow of currents within the rotor windings; therefore a mechanical torque can be created.
- When the rotor rotates in response to the created torque, then the position among the stator as well as rotor fields can be reduced, and the torque would be reversed in a 90-degree rotation. To maintain the torque performing on the rotor, PMDC motors include a commutator, set to the rotor shaft.

The commutator activates the current supply toward the stator thus as to continue a steady angle = 90, among two fields. As the flow of current is frequently activated among windings like the rotor twists, then the current within every stator winding is truly exchanging at a frequency comparative to the no.of motor magnetic poles as well as the speed.

## Characteristics of PMDC Motor

The characteristics of PMDC Motor include the following.



**Figure 5.6.2 PMDC Motor Characteristics**

[Source: “Electric Machinery Fundamentals” by Stephen J. Chapman, Page: 417]

The PMDC Motor characteristics are related to the dc shunt motor characteristic in terms of speed, torque, as well as armature current. But, the characteristics of speed-torque are more linear as well as conventional in these types of motors.

## Advantages and Disadvantages of the PMDC Motor

The advantages and disadvantages of the PMDC motor include the following.

- The size of these motors is smaller
- These motors are cheaper
- These motors do not need field windings, and they don't have the copper losses in the field circuit.
- The major drawback of this motor is, the generating capacity of working flux within the air gap is limited. But, due to the expansion of some latest magnetic material such as Samarium Cobalt & Neodymium Iron Boron, this trouble has been determined to some level.

## Applications of the PMDC Motor

- These motors are in several applications varying from fractions to numerous horsepower. These are designed with 200 kW to use in various industries.

- These are applicable in automobiles for operating windshield wipers as well as washers, to move up the lower windows, to drive blowers for air conditioners as well as heaters.
- These are used in computer drives, toy industries.
- These motors are applicable in food mixers, electric toothbrushes, and moveable vacuum cleaners,.
- These are used in a handy electric tool like hedge trimmers, drilling machines, etc.