Shenzhen City Ri Shengchang Magnet TechnologyCo., Ltd

Soft Magnetic Composite materials

SMCs

A change for motor design

Iron cores are essential components of motors , especially the silicon steel sheets with high magnetic permeability, so they win a big market. However, silicon also have many negative features, such as: it can cause high temperature environment, difficult to make special shapes, higher copper consumption.

Combining the market needs and silicon steel sheets disadvantages, our company manufactures a new product to replace the silicon steel sheets which named SMCs(Soft Magnetic Composite materials).

SMCs has much higher cost performance, it can help engineers to release their design methods, reduce overall procurement costs, streamline production processes, cut the number of motor parts, reduce the temperature of motors etc. SMCs is with good value.

What is SMCs?

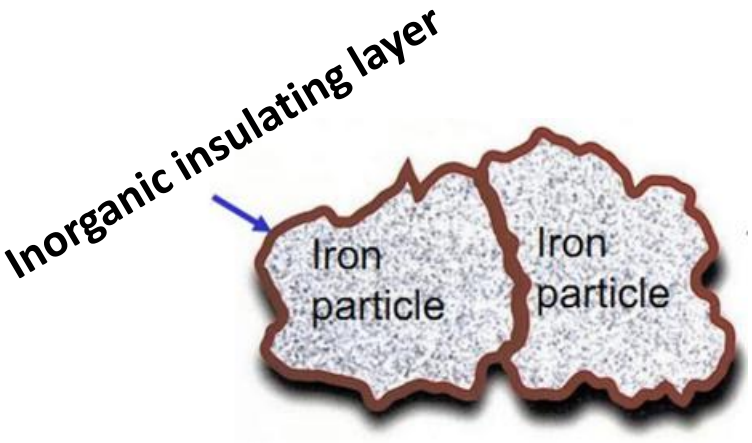
Application products

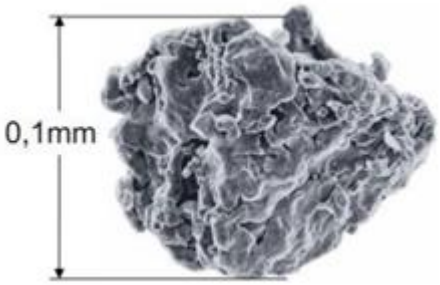
Application instance

Design process

Products series

What is SMCs?



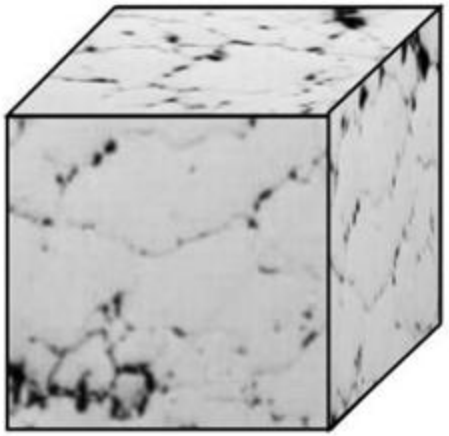


Special magnetic properties

High-purity iron
surface electrical insulation

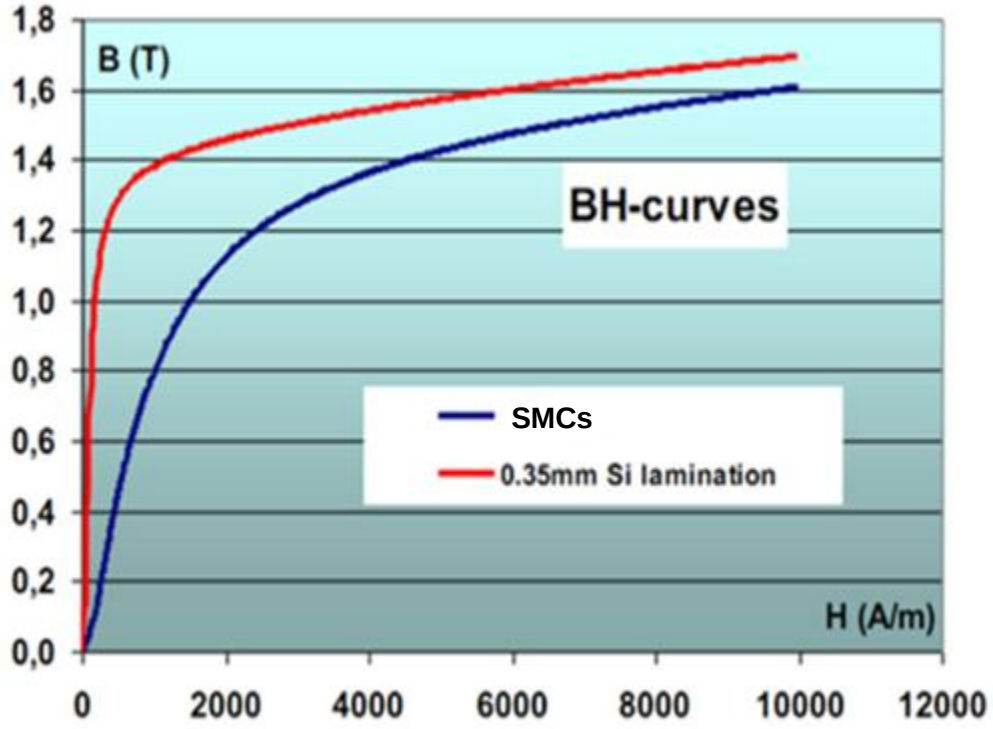
Material properties

High saturation magnetization
Low eddy current losses
Strong enough



Contrast between SMCs and Silicon

SMCs has Dispersed cavitation → magnetic permitivity is a little bit lower than Silicon steel sheet



SMCs magnetic permitivity depends on the real application

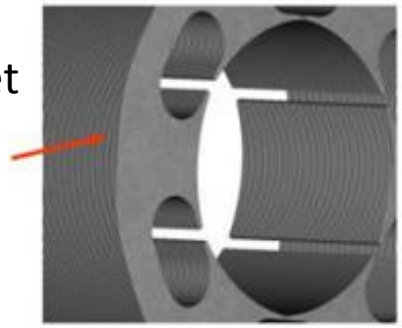
Contrast between SMCs and Silicon

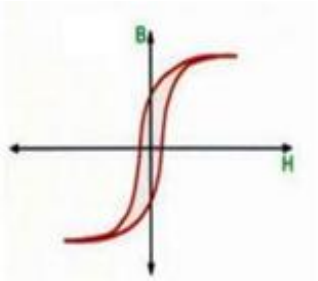
Total Losses(AC+DC Losses)= Hysteresis curve area

DC

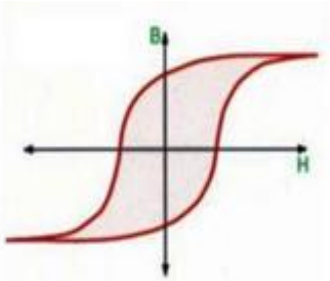
High frequency

Silicon Steel Sheet
Big size



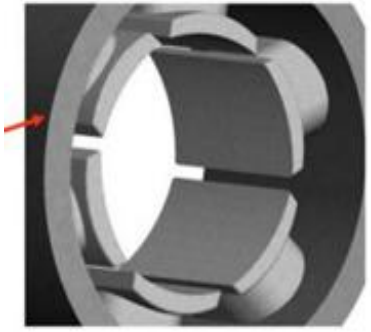


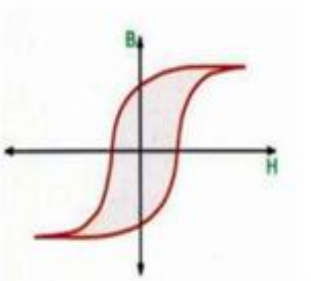
Low DC loss



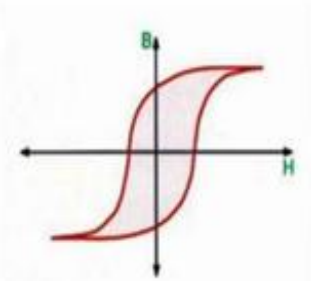
High AC loss

SMCs small size





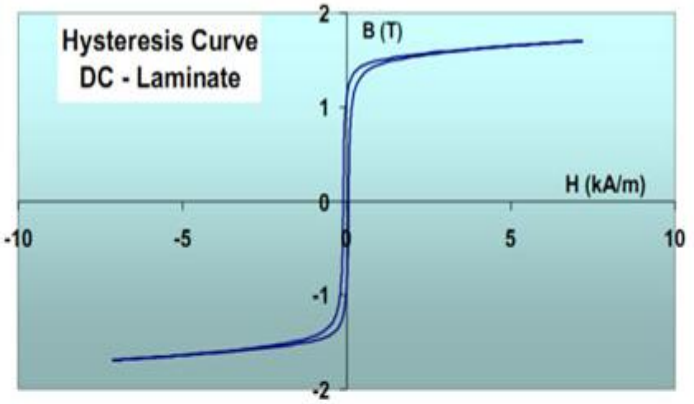
Medium DC loss



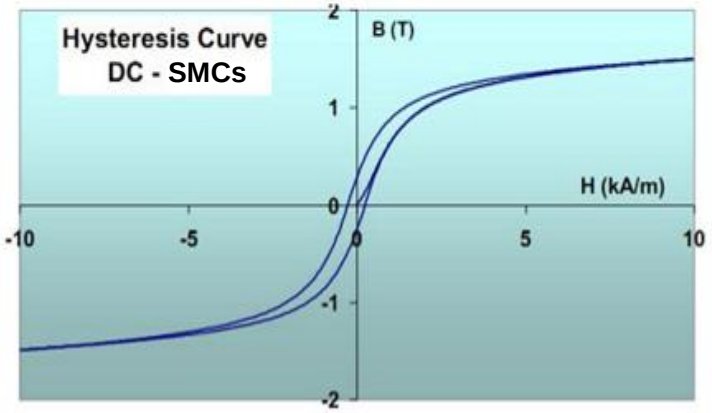
Low AC loss

Contrast between SMCs and Silicon

- 0.65mm motor silicon steel sheet
- Density 0.75g/ cm^3
- Test sample is Stamping cascade ring



- SMCs
- Density 0.73g/ cm^3
- Test sample is pressed and heat treatment



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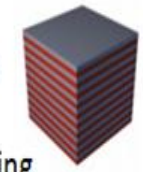
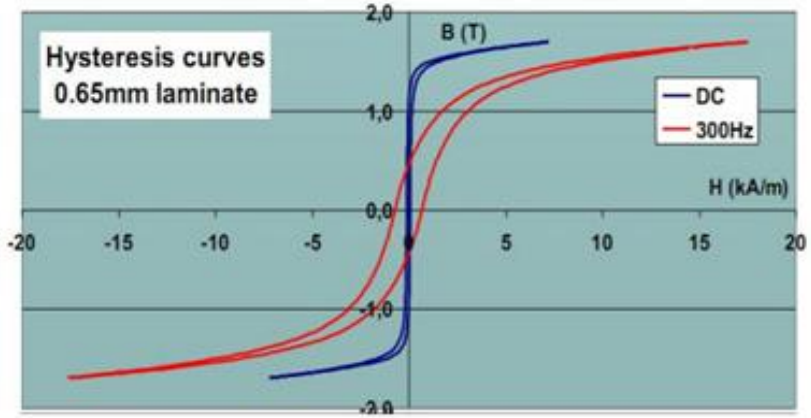
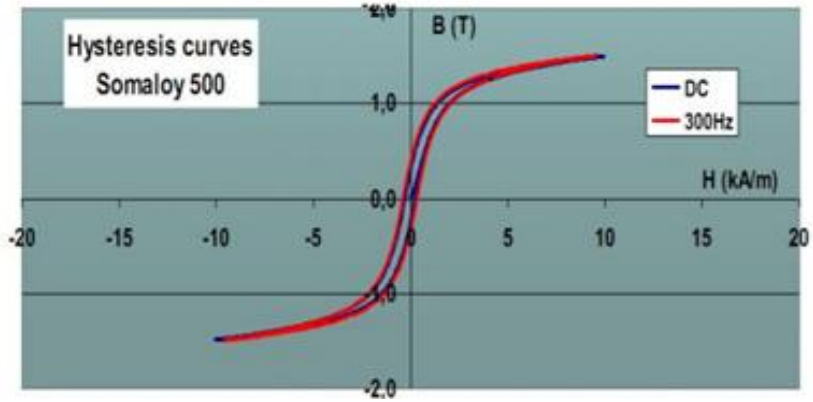




- **SMCs**
- Density 0.73g/ cm^3
- Test sample is pressed and heat treatment



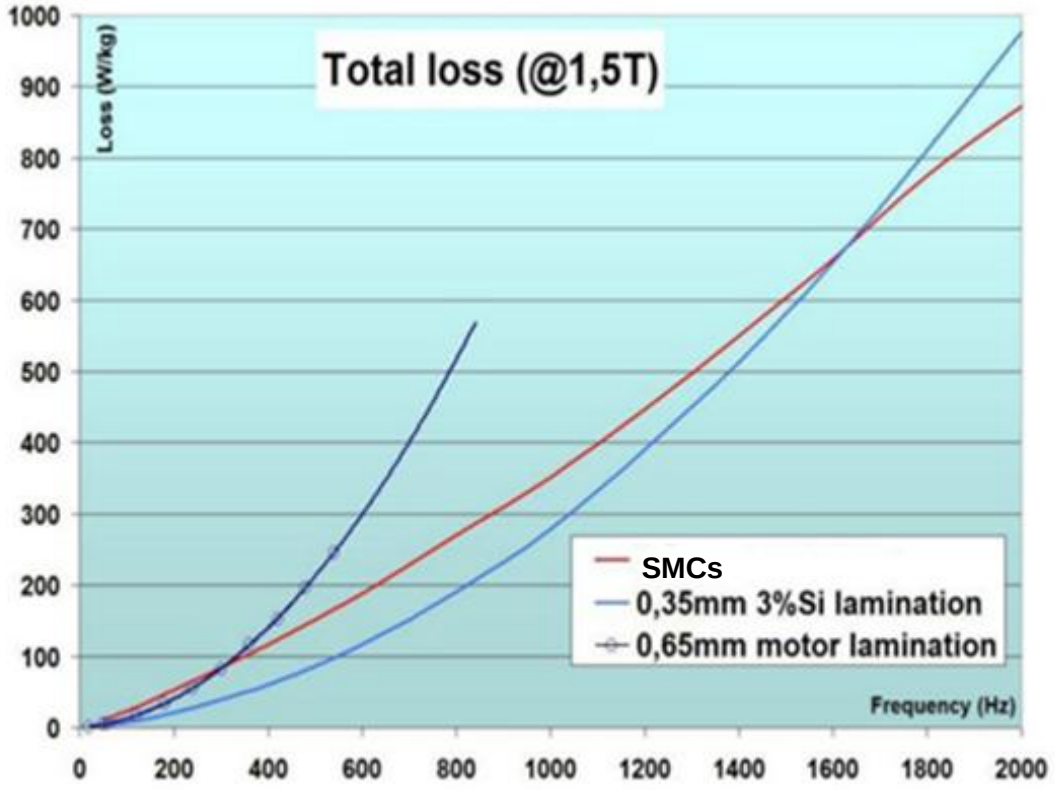
Contrast between SMCs and Silicon

-Hysteresis loss SMCs is higher

-Power loss SMCs is lower

-Hysteresis loss $\propto f$

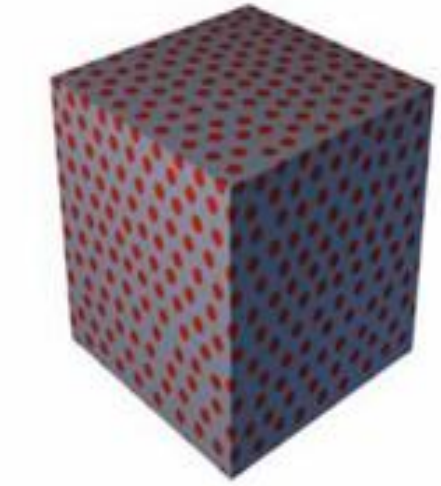
-Power loss $\propto f^2$



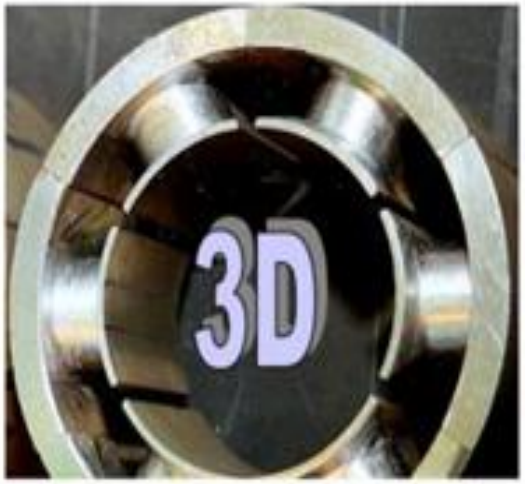
SMCs parts produce- Powder Metallurgy Process

Advantages:
→Three -dimensional shape
→Low cost
→High precision(IT 7-11)
→Smooth surface
→Low material loss(<5%)
→Low eddy current loss

SMCs main features and advantages



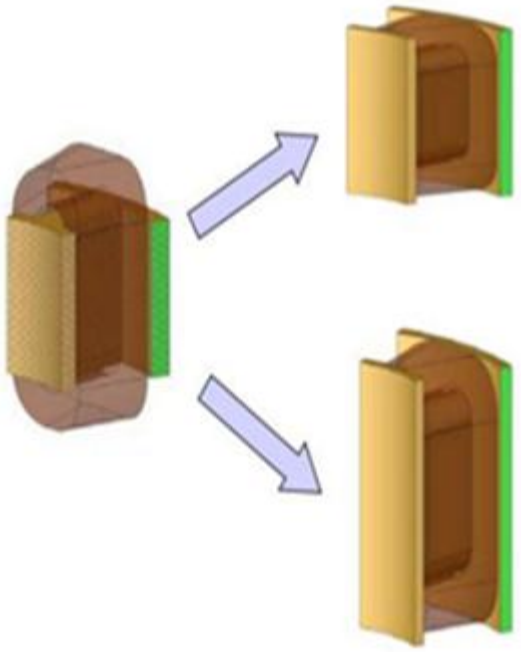
3D magnetic property



3D shape

smaller, lighter, and cheaper motor

SMCs advantages



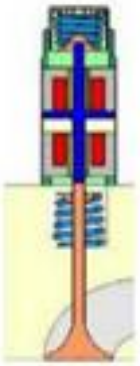
Laminated reference stator tooth

New design: the same performance
-Smaller axial dimension
-Significant savings in copper
-Closer winding / insulation gap is smaller

New design: the same length
-Performance Improvement
-the same performance,reduce magnet cost
-Closer winding / insulation gap is smaller

SMCs application

Motor
Sensor
Driving element
Reactance element
Ignition system



SMCs application and advantages

Motor type

Linear Motor

General Motor

DC Brush Motor

Claw Pole Motor

Brushless DC Motor

Advantages

Save copper
High Torque
Simple install
Sample design
Sample winding
Reduce magnet cost
Complete performance
Effective use of magnets
Elimination of the gearbox
Reduce the number of components

SMCs application and advantages

Application

Driver

Reactor

Ignition system

Advantages

Form easily

Save copper

Quick response

Fast and accurate drive

High-intensity operations

Low loss at high frequencies

SMCs sapplication-Linear Compressor

Linear Compressor

free piston cooler

- **Design theory:** Reduce assembly work

  If use silicon steel sheet, It needs 1,300 parts

  If use SMCs, it just needs 5 components

- **Advantages:**

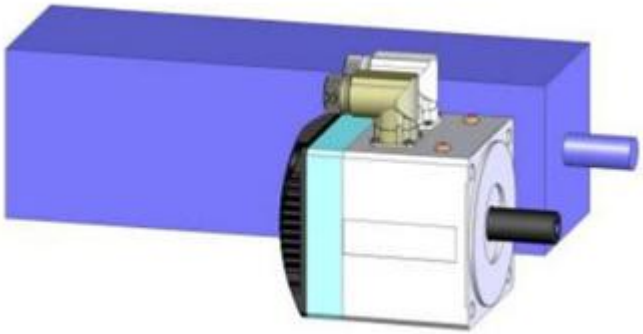
  1. easy to assemble and reduce cost
  2. similar performance

SMCs application-Servo motor

Brushless servo motors- Phase Motion Control S.r.l

Design theory: make the motors more smaller

Result:
Multi-pole design
Size and weight is 2/3 times of the old design
High torque



Servo motors Ultrac TW(left) and T(right)

SMCs application-Pump motor

DC brush pump motor- Aisin Seiki Co.,Ltd

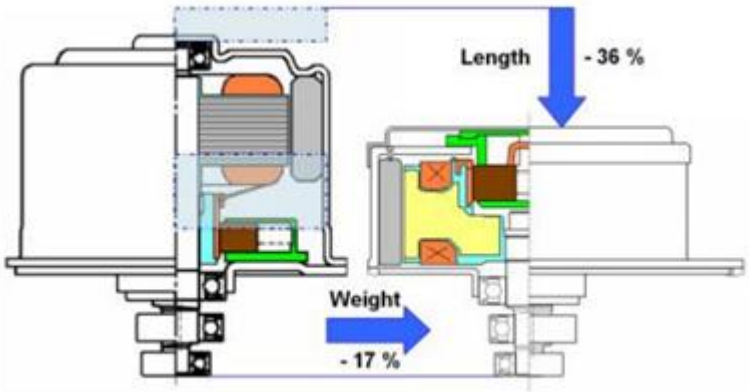
Design theory: make the motors more smaller

Result:

Reduced weight Significantly

Design is more compact

Magnetic flow is more denser



SMCs application-Pump motor

DC brush pump motor- Laing GmbH

Silicon Steel Sheet design: complicated design, much more Components, Spherical stator and rotor

New design theory: simplify the stator structure
Result: reduce the components numbers, make the stator more light, and the function is similar as the silicon steel sheet stator

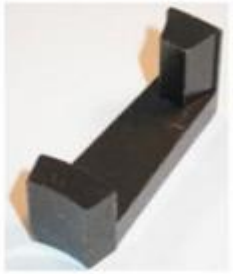
SMCs application-High torque drive

Valve drive stepper motor- Lyng Motor

Design theory: High torque drive system instead of hydro and wind power systems

Low cost

Without fuel leak



Result: Easy to install

Low cost

High accuracy

High reliability

SMCs application-Direct drive motor

Direct drive motor- SmartMotor A/S

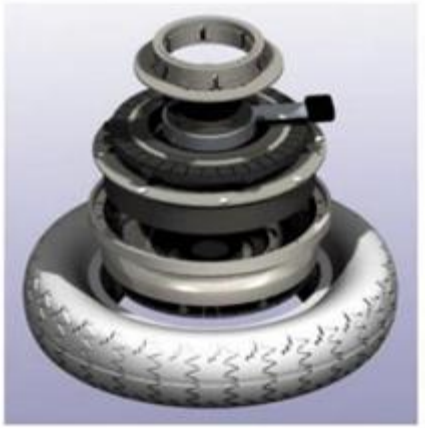
Design theory: direct drive wheel

It doesn't need gearbox in wheel motor

Result: Somaloy 3D design

Peak torque

Low noise



SMCs application-Diesel injector

Common rail system drive- Robert Bosch GmbH

Design Theoy: Suppression high-performance systems

Result: Canned core design

Precise valve control

High power drive

SMCs application-Ignition coil

Ignition Coil pulse transformer

Design Theory: Change size, make the structure more simple

Result: SMCs is easy to mold, and the surface is very smooth

SMCs application- Torque sensor

torque sensor- JTEKT Co.,Ltd,

Design theory: reduce cost

improve performance

Result: 50% cost reduction

performance improved by 30%

SMCs application-Power factor chokes

Power factor chokes-Optelec

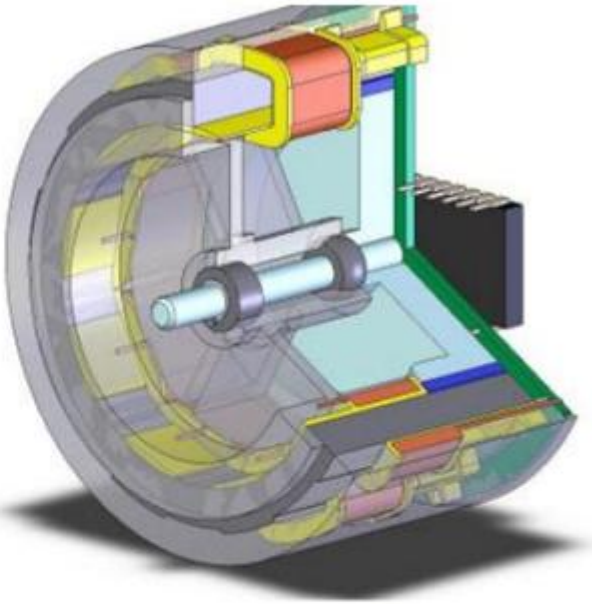
Design theory: flexible design

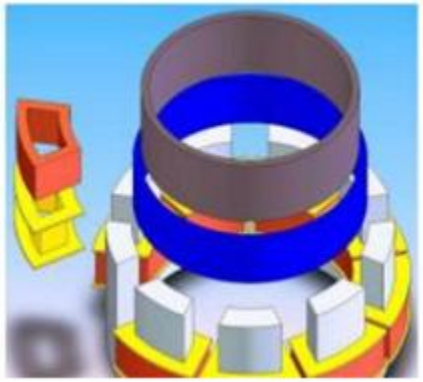
Result: by changing the design
it's very easy to improve the
performance

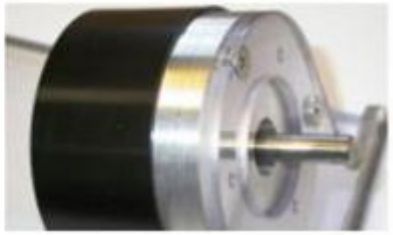
SMCs application- Vertical devices

Some features:

- Open internal
- Flexible rotor design
- Tape wound cores
- The stator is a whole part
  -high precision





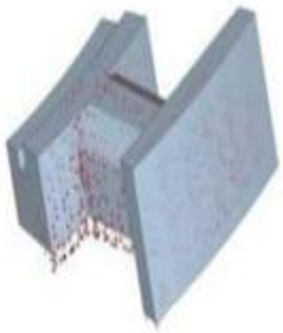


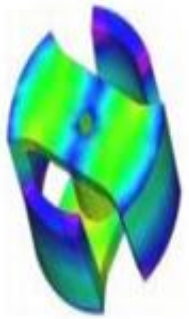
SMCs Design Process

SMCs design is different

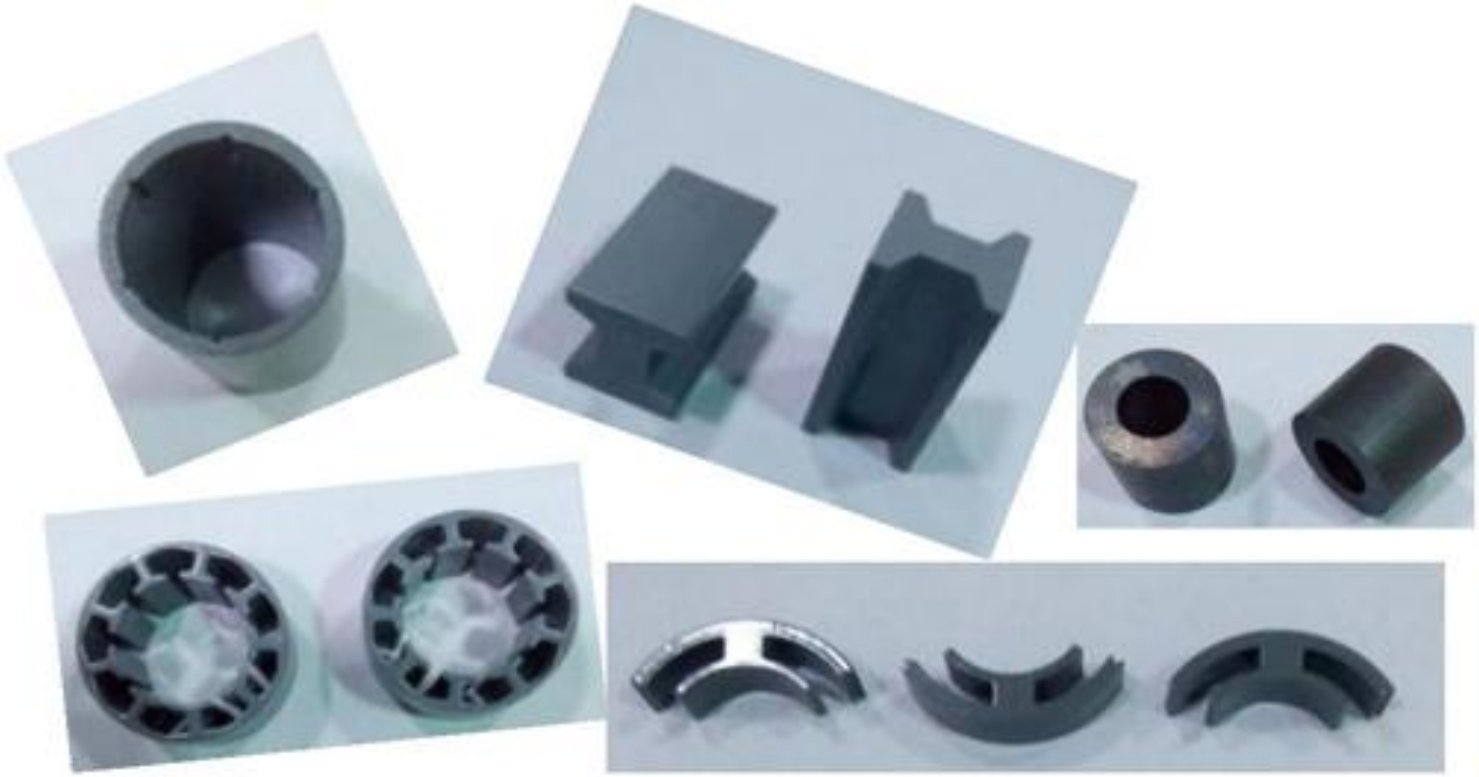
from Silicon Steel Sheet

When replacing Silicon steel sheet, it is recommended to design the whole structure, it can make the motors reach the highest performance

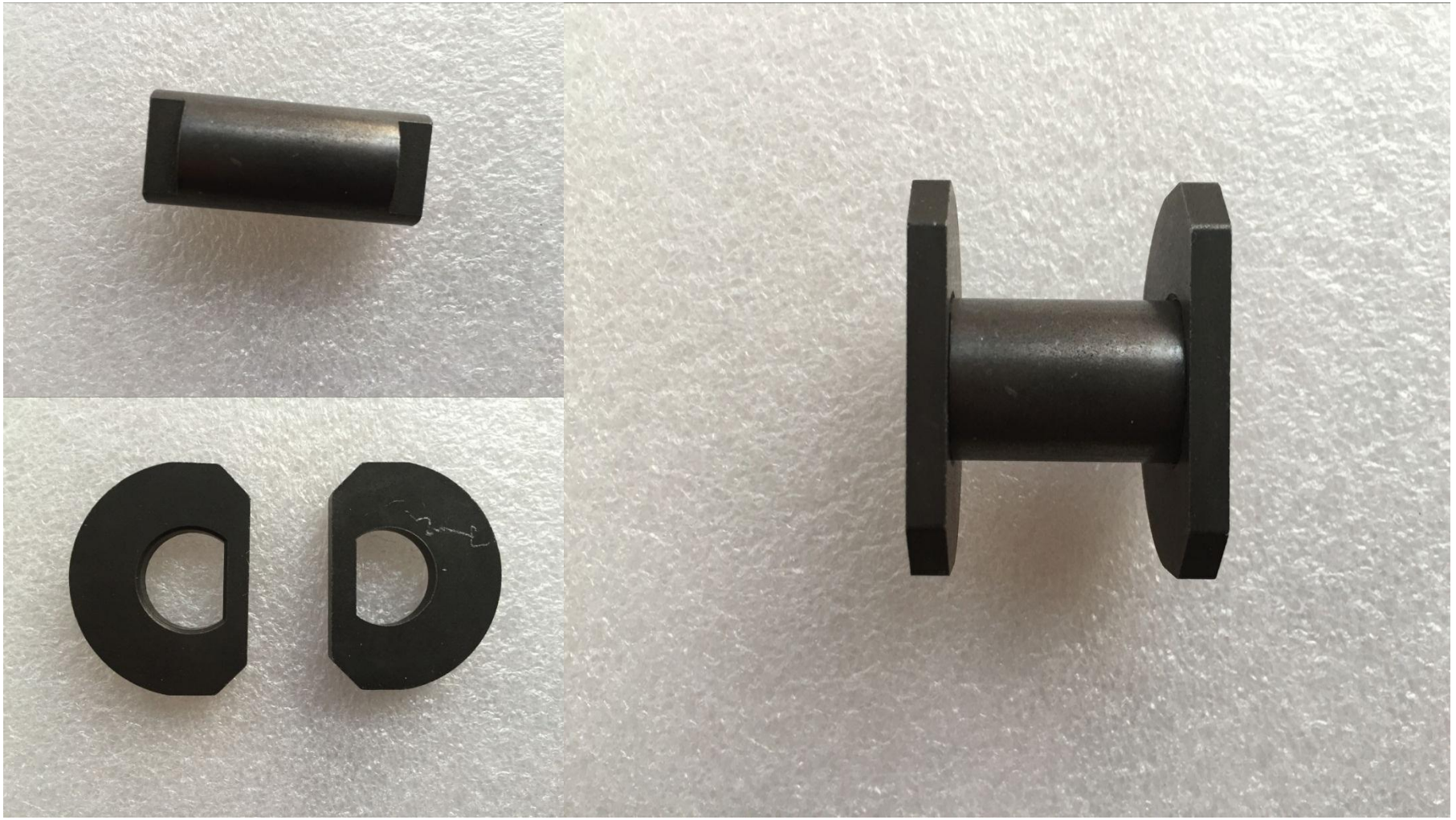




Already mass-produced SMCs



SMCs are used as ignition coil core



SMCs are used as ignition coil core

If the above description has some help to your company, please feel free to contact me

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