

September 10, 2015  
Aichi Steel Corporation

## MAGFINE<sup>®</sup> Dy-free Bonded Magnet Direct Injection Molding Technology -Applied to MAKITA Cordless Grass Trimmer-

Aichi Steel Corporation (Headquarters: Tokai, Japan; CEO: Takahiro Fujioka) has established their innovative “integrated molding technology” using MAGFINE Dy (Dysprosium) free bonded magnets<sup>(\*)1</sup> to develop a low cost magnet assembly<sup>(\*)2</sup> while achieving similar performance and quality to conventional sintered Nd (Neodymium) magnets.

High performance, high efficiency motors using conventional sintered Nd magnets require the magnets to be machined, then inserted and glued into the rotor core (laminated steel) and magnetized<sup>(\*)3</sup>.

On the other hand, MAGFINE Dy-free bonded magnets, which entered mass production and sale in 2011, can be formed into complex shapes without machining through the use of injection molding<sup>(\*)4</sup>, however, their lower magnetic force compared to sintered Nd has been a disadvantage.

With this new technology, the combination of the freedom of shape of MAGFINE and injection molding has realized the following, making it possible to bring a high power, high efficiency motor to market.

- ① Designing an ideal magnet shape that makes the most of the magnetic power of MAGFINE to ensure equivalent performance while retaining the size of the conventional design (motor using sintered Nd)
- ② Injecting the MAGFINE magnet directly into the rotor core (laminated steel) making up the motor to obtain fixing force to replace adhesives and eliminate the gluing step
- ③ Establishing process technology to both align<sup>(\*)5</sup> the magnet powder during injection molding and magnetize it allowing,
- ④ The elimination of the magnetization step

Utilizing this technology, Aichi Steel and Makita Corporation (Headquarters: Anjo, Japan; CEO: Shiro Hori) jointly developed a light weight outer-rotor type<sup>(\*)6</sup> brushless<sup>(\*)5</sup> motor rotor with superior cost-performance. Aichi Steel MAGFINE has been selected for use in a MAKITA Cordless Grass Trimmer.

We will use this technology to develop competitive magnets in the automotive, home appliance and industrial fields and benefit our customers by reducing manufacturing costs through simplification of manufacturing processes. At the same time, by increasing the applications of Dy-free MAGFINE, we contribute to the reduction in use of the heavy rare earth materials which are seen as a risk in supply chain security

\*1 Bonded magnet: A magnet made by mixing magnet powder with a plastic.

\*2 Magnet assembly: A component consisting of a magnet and rotor core (laminated steel)

\*3 Magnetization: Applying a powerful magnetic field to the magnet powder to activate its magnetic function

\*4 Injection molding: A molding method where heated resin is injected into a mold

\*5 Alignment: Aligning the direction of magnetic powders to maximize their magnetism

\*6 Outer rotor type: A type of motor where the magnet (rotor) is placed to rotate around the outside of the motor

\*7 Brushless motor: A motor where the mechanical contact such as brushes are replaced by an electronic circuit

<Reference material>

Table 1 Process simplification

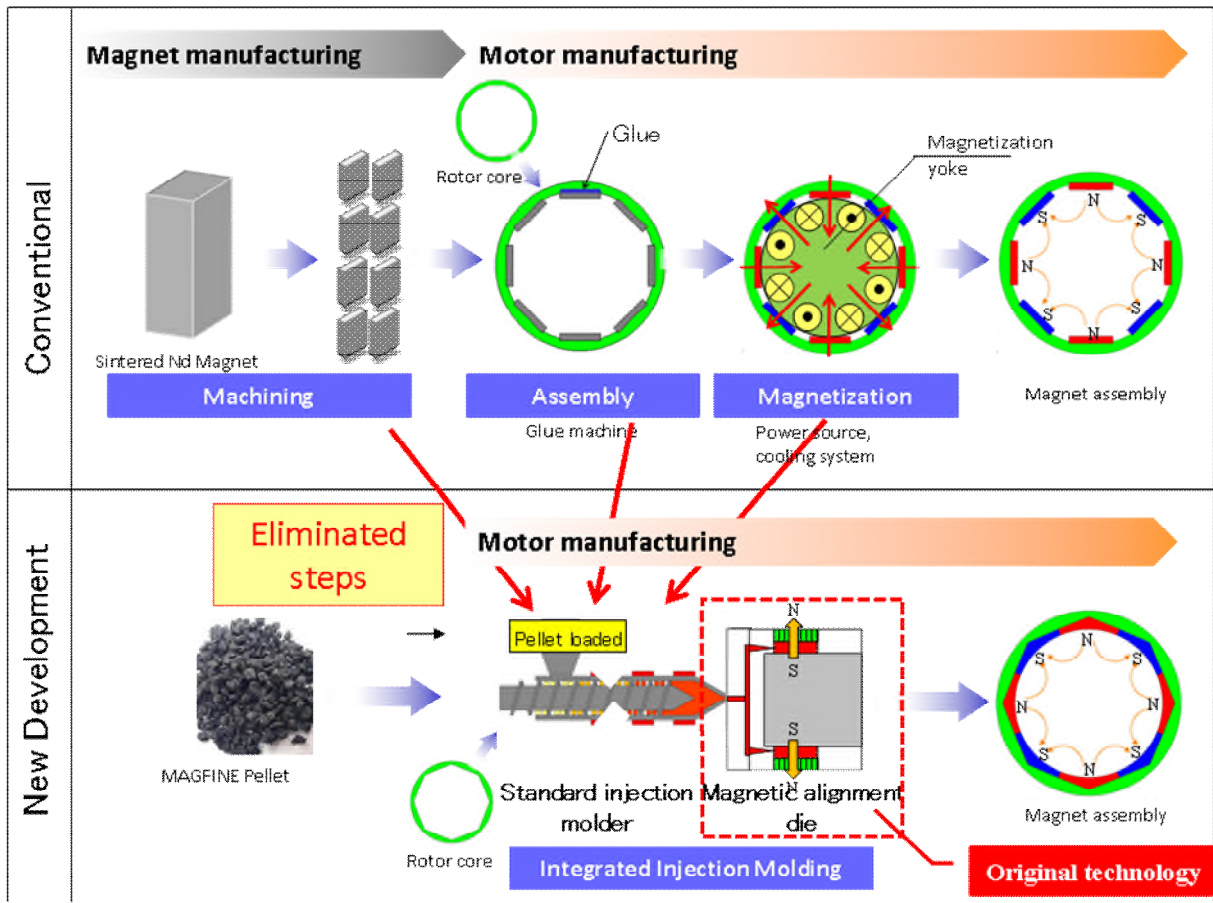


Figure 1 Outer rotor type brushless motor schematic diagram

