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News Release

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Aichi Steel Corporation

Success in Experimentally Proofs the World's First High-Speed, High-Reduction Next-generation Electric Axle

- Further resource saving, smaller size and lighter weight provides steady progress toward practical adoption -

Aichi Steel Corporation (President: Takahiro Fujioka) has combined a newly developed compact high speed reducer with a compact and lightweight 34,000 rpm motor[*1], which was experimentally proofed in January 2021, to save resources and attain a compact size. For the first time in the world, Aichi Steel has succeeded in proofing the technology of a high-speed, high-reduction next-generation electric axle with high-speed rotation and high deceleration that contributes to weight reduction.

This proof is a result of the "Technology Development/Demonstration Project that Contributes to Substitution of Part Materials and Reduction of Usage" commissioned by the New Energy and Industrial Technology Development Organization (NEDO).

As a response to the depletion of resources caused by the full-scale spread of electric vehicles, Aichi Steel is working on the practical application of electric axles that are both compact and lightweight with an excellent power consumption rate that contributes to a significant reduction in the amount of used rare earth elements such as Nd (Neodymium), electrical steel sheets, and copper.

This electric axle integrates a newly developed compact high-speed reducer with built-in high-strength, high-precision gears and shaft based on from steelmaking to forging at one site technology with a compact and lightweight high-speed rotation motor that uses a dysprosium (Dy) free-bond magnet "MAGFINE®"[*2]. It is a combination of the extensive material technologies that we have cultivated over many years.

1. Smaller Size and Lighter Weight

(1) Compact High-Speed Reducer

In the proofs using this high-speed reducer, the reduction ratio*3, 21.8 (more than twice the ratio of a general electric axle) was realized in a compact size while maintaining efficiency comparable to that of a general electric axle, and the torque (strength of rotation) necessary for running an electric vehicle from a small and lightweight motor was obtained – 1,850 N-m.

(2) High-speed Rotation Motor

While taking advantage of the features of "MAGFINE®" (high magnetic force, high electrical resistivity, integrated molding into the rotor core*4) the performance*5 of the magnet powder has been further improved through joint development with Tohoku University, resulting in a 50% reduction compared to general motors (a reduction of 10% compared to our previously developed products) while maintaining 34,000 rotations per minute to enable a smaller and lighter motor.

2. Excellent Recyclability

(1) For rare earth elements, which are directly linked to magnet resource problems, it is possible to reuse magnetic particles containing neodymium (Nd) by taking advantage of the characteristics of bonded magnets. (A magnetic particle recovery rate of 90% was reached in experiments.)

(2) Forged products (gears and shafts) are reused as raw materials for specialty steel after use (resource recycling).

In the future, we will further refine our technologies at the "Aichi Steel x Tohoku University, Materials & Process for the next-generation Electric Axle Co-Creation Research Institute", which was established in October 2021.

Aiming for the implementation of innovative electric axles, Aichi Steel will contribute to the realization of carbon neutrality by solving the resource and power consumption problems associated with the widespread use of electric vehicles.

*1 January 7 2021 News Release https://www.aichi-steel.co.jp/ENGLISH/20210107_news_Eng.pdf

*2 Magnet molded by mixing various resins with Nd (neodymium) anisotropic magnetic powder without se of the rare earth element Dy (dysprosium). Used in electric tools and seat motors for vehicles

*3 Reduced the number of tire revolutions relative to the number of revolutions of the engine. A reducer with a larger reduction ratio is required as motor speed increases.

*4 integrated molding: Innovative production method of molding by filling a motor rotor (electrical steel sheet) in a magnetic field with the magnetic compound (magnetic powder and resin)

*5 Succeeded in improving the performance of Dy-free anisotropic Nd-Fe-B magnetic powder in joint development with Tohoku University.February 9, 2021 News Release https://www.aichi-steel.co.jp/ENGLISH/20210209_news_Eng.pdf

Fig. 1 Overview of Next-generation Electric Axles

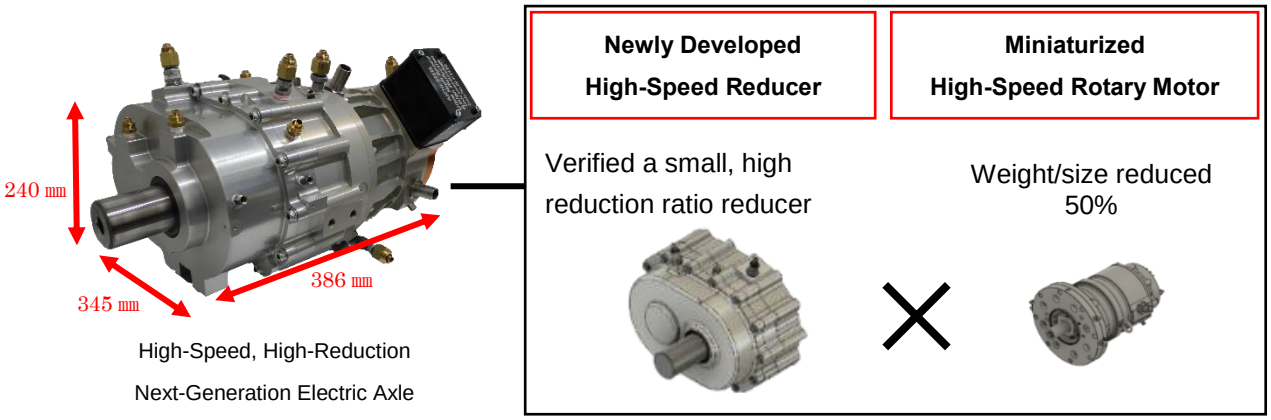

Fig. 2 Image Showing Comparison with a General Electric Axle

Compared to general electric axles with the same output, the volume and weight have been reduced by approximately 40%