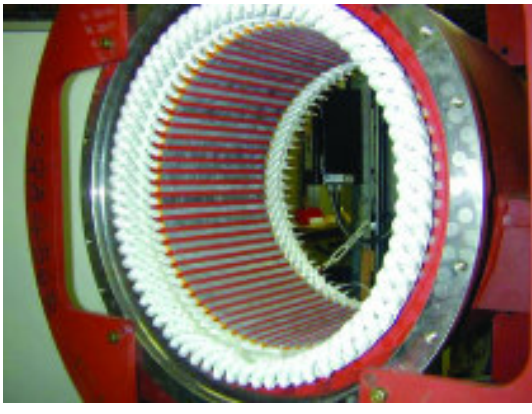
The permanent-magnet motor: concentrated energy

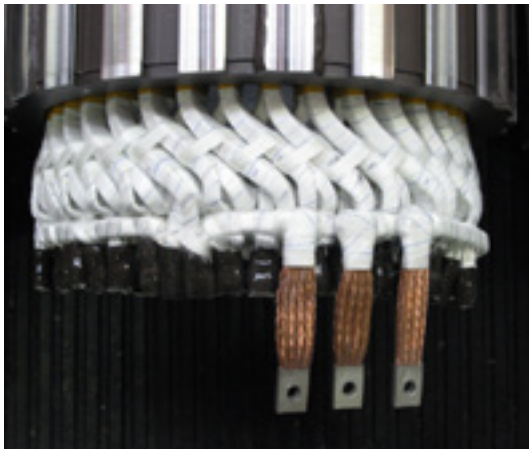
> Context

At a time of growing concern over energy costs, optimising the output of traction systems has become a real challenge. However, recent progress made in the field of power electronics (IGBT undulators) and electrotechnics (permanent-magnet motors) has made it possible to increase the latest generation of electric motors' performance. In conjunction with these advances, the drop in the costs of materials used for these technologies (samarium-cobalt, rare earths) has enabled their use in industrial applications, in particular in the railway sector, thereby opening up new perspectives in terms of performance, energy consumption and maintenance costs. The AGV is the first train in the world equipped with high-powered permanent-magnet synchronous motors.

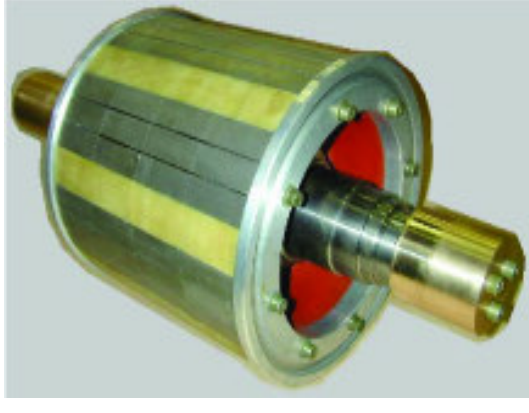


> Principle

To create electricity, a permanent-magnet motor functions on the same principle as a bicycle dynamo. The advantage lies in the power/weight ratio (power per unit mass), which exceeds 1 kW/kg, compared to 0.8 kW/kg for earlier generations. Capable of excellent output, they also offer the advantage of being compact and energy efficient. The use of these magnets, which create the magnetic field necessary for the motor to function, makes it possible to eliminate the energy losses typical of a classic electric motor. These motors are fed by electronic converters using high tension IGB-type switches, which are more compact than GTO-type electronic switches.



Thanks to these more powerful traction elements, the number of motor bogies can be optimised on the AGV, thereby enhancing reliability, seating capacity, train weight and maintenance costs.



> Advantages

- High power per unit mass, in excess of 1 kW/kg
- Reduced energy consumption: 98% output
- Compactness: occupies one-third less space than an asynchronous motor
- Simplicity of integration