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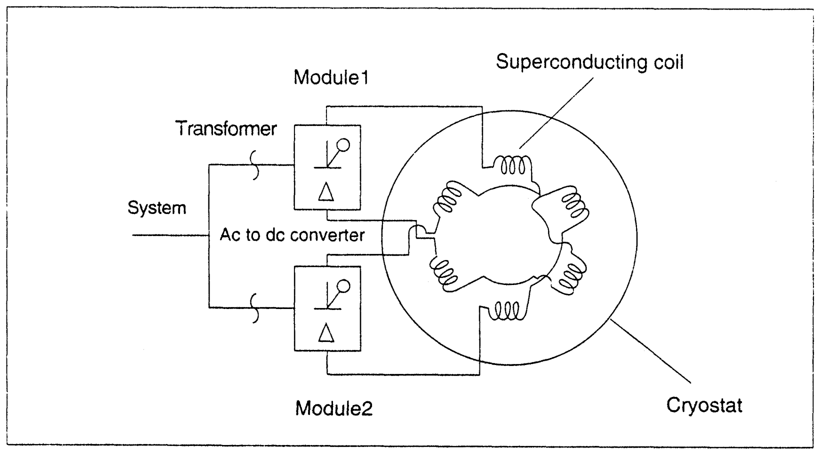
# *News Briefs*

## HIGH–PERFORMANCE CARBON MAGNET

The National Institute of Materials and Chemical Research of the Agency of Industrial Science and Technology has succeeded in improving by a factor of 50 the magnetic intensity of the carbon magnet, the next generation magnetic material. The saturation magnetisation of 16.2 emu G/g has been achieved. The carbon magnet is an organic magnetic material containing elements such as carbon, hydrogen and nitrogen. It possesses low density,, excellent corrosion resistance and low mass. Carbon magnets have been usually manufactured from polymer materials such as polyvinyl chloride and have very low saturation magnetisation, of the order of 0.3 emu G/g, apart from poor reproducibility. In the new manufacturing technique, monomers such as di–n–propylamine are used as starting materials which are placed in a vacuum quartz reaction chamber and heated to 950°C for over 45 minutes. The carbonaceous matter thus formed is exposed to plasma treatment to form a carbon magnet. Although the saturation magnetisation thus attained is by a factor of 3 to 5 lower than that obtained when iron oxide or nickel are used, it is sufficient for applications such as toners in copying machines.

## SUPERCONDUCTING MAGNETIC ENERGY STORAGE

Kyushu Electric Power Co., Inc.(Japan) has started setting up a superconducting magnetic energy storage (SMES) (see the Figure below), with Japan's largest capacity of 1 kWh. Three years later it will be installed in a sub–station. SMES stores the electric energy (particularly at night when the power supply is in excess)



in a superconducting coil and releases it during the day when the demand for power is at its peak. The SMES system comprises a coil of Nb–Ti alloy cooled to 4.2 K by liquid helium. Its storage efficiency of 90% is considerably higher that than of pumped–storage power generation of 70%. To compete with such a conventional system (3 – 5 GW), a single SMES coil would have to be several hundred meters long. A set of modules 3 m in diameter and 2.5 m high is designed by Kyushu Electric Power Co. to reduce the size.

## MAGNET SCRAP RECOVERY

The US Bureau of Mines has recently developed technology to treat and recycle a variety of wastes that contain valuable and strategic materials. Part of this effort concentrated on a process to reclaim neodymium and other rare earths from iron in NdFeB permanent magnet scrap. Scrap material from rare earth permanent magnet production typically contains about 30% (by weight) of neodymium. Since the demand for this important magnetic material constituent is ever increasing in importance, cost–effective methods of recovery could have a significant impact on the rare earth permanent magnet industry.

The scrap recovery process uses a hydrometallurgical, $H_2SO_4$ dissolution–precipitation technique for separating rare earths from the NdFeB scrap material. The process first involves selecting rare earth magnet scrap to be recycled, it is then crushed and dissolved in $H_2SO_4$. The leachate is transported to a reaction vessel containing $NH_4OH$, mixed, and the resultant precipitate filtered to separate neodymium double salt from the spent leach solution. The Nd double salts are converted with HF to commercially valuable $NdF_3$ and the spent leach solution is converted to iron jarosite and boron. The process is covered by the US patents No. 5,129,945 (Neodymium recovery from magnet scrap) and No. 5,238,489 (Treatment for rare earth recovery from mixed magnet swarf). (From *RIC News, March 1, 1994*).

## PLASTIC MAGNETS

Research and development for better rare earth permanent magnets resulted in materials that can be used in a variety of new applications. Two Japanese companies report on breakthrough that could increase the markets for NdFeB magnets. Plastic magnets are produced by forming metallic magnetic powder in a plastic resin matrix.

Ultra–thin rare earth permanent magnets with thickness of 0.5 mm are now in production (Seiko–Epson Corp.). Daido Steel Co. has started commercial production of plastic NdFeB magnets that can withstand temperatures of up to 180°C. This compares with a previous maximum temperature of 120° for the same type of magnet. The magnet can withstand the higher temperatures by coating the material with a special resin which prevents oxidation from the higher heat.