Magnetics: Industry Overview *by* Walt Benecki

Cincinnati Conference Highlights Motion Control Systems Technology Advancements

On September 9-11, 2002, Gorham Advanced Materials, Inc. sponsored an informative Conference entitled "Permanent Magnet Systems and Power Electronics for Motion Control" in Cincinnati, Ohio. In spite of the challenging economic times, the conference was fairly well attended by motor manufacturers, systems designers, power electronics manufacturers and magnet producers. Prior to the full conference, representatives of VAC Magnetics Corporation, Elizabethtown, Kentucky offered a comprehensive workshop entitled "An Introduction to Intelligent Motion" which covered adjustable speed motors, drive electronics, EMI abatement and material selection criteria.

Contrary to many previous Gorham conferences that have emphasized magnets and magnet producers, Gorham and general conference chairman, Burley Semones, President of MTM Consulting, structured the conference to focus on the total motion control system, covering materials and components (including magnets), motors, sensors, and power electronics. In his opening remarks, Semones emphasized that this novel approach was aimed at bringing "connectivity to the many technologies that support the Permanent Magnet Industry while bringing focus to all the other components that make up Motion Control Systems". Semones emphasized that during systems development, it is critical to recognize and understand the relationship between the drive electronics, the electric motor and the permanent magnets. Keynote speaker Peter Cho, President, ETechno-Group, Anderson, IN predicted expanded presence of motion control systems in automobiles and called for more integrative efforts between motor, power electronics and controller manufacturers.

One of the first conference papers was presented by Muhammed Mubeen, Senior Research Associate with Motion Tech Trends, Inglewood, CA. Mubeen indicated that the 2002 world production of PM motors is expected to be 4.7 billion units, with a total value of approximately $39 Billion. Of

these totals, sub fractional motors account for 89% of the units and 51% of the dollar value. Japan and China account for approximately 50% of the world production of permanent magnet motors and it is expected that China will continue to expand its market share in future years. Mubeen concluded that, "Opportunities for permanent magnets in the motion control industry will continue to grow at a healthy rate".

An interesting new machine design concept was described by Jeff Day, VP, Global Business Development, LE Inc., Indianapolis, IN. Day described a new generator design concept that utilizes amorphous metal core material substituting for traditional silicon steel. This unique core results in a net increase in machine efficiency, increased power density and reduced cost per unit of power. Day called for design engineers to develop a power electronics package below $15/kW capable up to 2,000 Hz.

Thomas Jahns, from the Electrical & Computer Engineering Department, University of Wisconsin-Madison, described a novel design project for an Interior PM Synchronous (IPM) motor for motion control applications. Jahns described a comprehensive design approach to the overall development of a rugged motor design that may find future applications in air conditioners, machine tools, automotive starter/alternators and selective aerospace applications.

Raymond Sepe Jr., VP of R&D Services for Electro Standards Laboratory, Cranston, RI, presented a paper entitled "Fault Resilient Permanent Magnet Motor Control for Automotive Applications". Sepe described a robust and technically advanced control system that someday could permit advanced identification of a component or system failure. The system would provide electronic feedback of a pending failure to a technical expert who could utilize real-time monitoring to notify the user of pending system problems if an immediate maintenance solution was not readily available. The concept was unique and may take considerable time to reality. But certain aspects of Mr. Sepia's concept were novel and caught the attention of even the most hard core skeptics in the audience.

On the magnet side of the equation, Dr. James Bell, Director of Technology, Magnet Applications Group provided an overview entitled "Bonded Magnets for Motors and Sensors". Bell outlined a number of current advancements in bonded magnets including printed magnets, two stage injection molding, molded-in functionality, single and double-sided

magnetization, skewed magnetization, and "reverse wrap" 2-pole Halbach magnets. Bell stated that he expected three major factors to impact the magnet industry over the next few years: the automotive conversion to 42 volt systems, additional industry consolidation and continued market penetration by Chinese magnet producers.

Dr. Juji Kaneko, Deputy General Manager of the Technical Department of Sumitomo Special Metals' NEOMAX Division reviewed recent technological advancements in sintered Neodymium Iron Boron magnets, including high purity NdFeB which provides improved high temperature stability and higher residual flux density. Kaneko also offered an update on current developments aimed at improved and lower cost coating technologies. Kaneko provided incite that, although total production of NdFeB magnet production in Japan declined in 2001, motor applications as a percentage of total production continued to increase.

In one common theme that evolved over the two-day conference, design engineers and motor manufacturers, while recognizing the significant strides made over the past 5-10 years by manufacturers of rare earth magnets, urged magnet manufacturers to further improve magnet performance and reduce magnet costs. In a final panel discussion lead by chairman Burley Semones, it was generally agreed that magnet decisions must be made with total system requirements in mind and that magnet selection is often determined relatively early in the system design process. Panelists also agreed that recently announced bonded magnet technologies, extending into the 20-25 MGOe range, represent potentially attractive feature advancements for motion control system designers.

Walt Benecki is the former president of Group Arnold and a past president of the Magnetic Materials Producers Association. Walt has established a consulting practice focused on the worldwide magnetics industry. Contact him at waltbenecki@aol.com