

# TOSHIBA REVIEW

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## Special Reports I

### New Mobile Era Supported by Batteries

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### Megatrends in Power Systems through Application of Intranet Technologies

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## Special Reports I

### New Mobile Era Supported by Batteries

#### \*Batteries Leading Advanced Mobile Applications

ARAI Sakae

#### \*Market and Technology Trends in Batteries

KANDA Motoya UENO Fumio

Many types of mobile devices such as cellular phones and notebook computers are becoming commonplace throughout the world, with vast numbers of batteries being used to drive those devices. Most of the batteries used for mobile devices are small-rechargeable types. The production and use of lithium-ion batteries has grown significantly in recent years due to the superior energy density that lithium-ion batteries offer over other rechargeable products.

Desirable features of those mobile devices are their small size and weight coupled with long operating times. Thus, batteries are expected to offer increasingly higher performance to fulfill those aspects. In contrast, larger rechargeable batteries can store and provide more electrical energy as it is needed. There is, therefore, clear potential for batteries to solve the problems of energy and environment, which will be primary issues in the 21st century.

#### \*Ultrathin Lithium-Ion Battery Using Aluminum Laminated Film Case

TAKAMI Norio

Prismatic lithium-ion batteries (LIBs) using a metallic can as the case have been commercialized for cellular phones, and demand has consequently arisen for thinner and lighter prismatic LIBs. We have developed key technologies to make LIBs thinner and lighter. The metallic can has been replaced by an aluminum laminated film bag with a thickness of about 100  $\mu\text{m}$ . By developing a thermally stable liquid electrolyte and a high-capacity carbon fiber negative electrode, we realized a thin LIB using a laminated film bag that we refer to as the ultrathin lithium-ion battery. An ultrathin lithium-ion battery with a thickness of 3.6 mm was shown to have a high energy density of 172 Wh/O, good discharge performance, and high capacity at  $-20^{\circ}\text{C}$  in comparison with polymer lithium-ion batteries (PLBs).

#### \*Ultrathin Lithium-Ion Battery Performance and Applications

HASEBE Hiroyuki

An ultrathin lithium-ion battery for cellular phones was developed and commercialized.

This battery is characterized by excellent low-temperature discharge performance, good safety and low swelling at high temperatures. The ultrathin lithium-ion battery's aluminum laminated film outer jacket enables flexibility of battery size.

These characteristics are well suited to the requirements of recent portable information equipment. When ultrathin lithium-ion batteries with large footprint were produced and evaluated, it was found that the large-footprint ultrathin lithium-ion batteries offer excellent overall performance, with little performance degradation caused by partial heat.

#### \*High-Capacity Prismatic Lithium-Ion Battery

KOBAYASHI Kazuo HASHIMOTO Minoru KATOH Masahiro

The trend toward downsizing and weight reduction of mobile equipment has led to the need for higher energy density and improved characteristics in lithium-ion batteries as their power source. Graphitized mesophase-pitch-based carbon fiber (MCF) has been used as a negative electrode in such batteries. We have now developed the boron-added MCF (B-MCF) electrode, which realizes higher capacity. We have also improved the positive electrode by optimizing the conductive carbon material. In addition, we have achieved several improvements such as the vent design for the aluminum can. As a result, our prismatic lithium-ion battery features the highest energy density and high reliability.

#### \*New Nickel-Metal Hydride Battery Technologies for New Applications

TAKENO Kazuta TANAKA Haruhiko AKAMOTO Yukinori

We have developed the new "PT type" nickel-metal hydride (Ni-MH) battery as a secondary battery with large current discharge capability as well as high energy density, using enhanced material, electrode control, and current-collecting structure technologies. This new type of Ni-MH battery is capable of discharging at 30A in continuous mode and at 50A in pulse mode. Since it still maintains a 60% higher volumetric energy density than the nickel-cadmium battery, it is expected to contribute to a new generation of power tools and cordless vacuum cleaners with its small and light characteristics.

In parallel with the cell development, we developed a newly designed battery pack with an enhanced air-cooling structure, which was designed using computerized thermal simulation, as well as an ultrarapid charger with pulse mode charging control, which is capable of charging the battery within 15 minutes. These ensure better utility and longer productive life for the battery.

#### \*Using Primary Batteries with Various Types of Portable Equipment

OKAYAMA Teiji HIRAHARA Satoshi KIKUMA Yuichi

The new mobility in electronic devices is bringing significant growth to both the Ni-MH and lithium-ion secondary battery market and also to that of primary batteries, which can be bought anywhere, are inexpensive, are easy to use, and can be stored long-term. With the more widespread use of primary batteries in portable equipment, requirements now include not only high capacity, but also high current discharge rates and low-temperature discharge performance.

In response to this trend, a new Version of the "Alkali 1" alkaline battery has been developed. It is suitable for use in digital still cameras, which require especially high current discharge rates. Other types developed include a cylindrical type lithium battery with improved high-current discharge performance over a wide temperature range, and button type zinc-air batteries.

## Special Reports II

### Megatrends in Power Systems through Application of Intranet Technologies

#### \*Intranet Technologies Adopted in Power Systems

KAWAI Michio

#### \*Future Power Systems Adopting Intranet Technology

HAYASHI Hideki TSUKUI Ryoichi YOKOTA Takeshi

Information technology (IT) systems using Internet and intranet technologies are expanding with great rapidity. At the same time, systems with intranet architecture have been adopted slowly in power systems, in which real-time performance and reliability are essential. Up to now, energy management/supervisory control and data acquisition/distribution management systems (EMS/SCADA/DMS), control/protection systems, and monitoring systems for breakers and transformers have been individually developed. It is necessary to make complex connections between each of these systems in order to realize a total system.

The optimal total system can be easily realized by using intranet technology, which is expandable. The adoption of intranet architecture in power systems is therefore expected to progress rapidly from now on.

#### \*Intranet Technologies Realizing Additional Smart Functions for Power System Protection and Control Systems

INUKAI Michihiko HASEGAWA Osamu TAKANI Hideyuki

Power system protection and control equipment in substations can be provided with additional smart capabilities by operating them as network terminals. We have developed the network computing unit (NCU) board as one of the solutions for such applications. By inserting NCU boards, a protection and control system integrated with additional functions, such as remote maintenance and fault location, can be easily and economically constructed.

#### \*Intranet Technology Adopted in Monitoring and Diagnosis of Substation Facilities

YOKOTA Takeshi UEHARA Kyoichi

Reliability-centered maintenance (RCM) has been proposed recently in order to minimize maintenance costs while securing the reliability of substation facilities. Monitoring and diagnostic equipment is highly important for preventive maintenance and predictive maintenance in RCM. Such monitoring and diagnostic equipment must offer good economic efficiency and high performance. Although a concrete image of RCM for substation facilities has not yet clearly appeared, European manufacturers have begun to produce monitoring and diagnostic equipment aiming at preventive and predictive maintenance for RCM.

This paper describes a network type monitoring and diagnostic system for substation facilities developed recently by Toshiba. This system applies the latest intranet technology. The new monitoring and diagnostic equipment is expected to be effective in reducing maintenance costs while securing the reliability of substation facilities.

#### \*Application of GIGASOLUTION™ to IT Systems for Electric Utilities

MIYAJI Hideyuki EBATA Yoshio KISHIDA Yukio

Technologies related to the Internet and intranets have been rapidly developing with the growth of computer networks. The use of intranets was formerly limited to the sharing or referencing of information in certain groups. Recently, however, their use has expanded to mission-critical systems.

To meet these requirements, Toshiba has developed GIGASOLUTION™, a high-performance intranet package that satisfies the requirements of high responsiveness and high reliability which are essential in mission-critical use. This paper describes several information technology (IT) systems for electric utilities that promote rationalization and business innovation making use of the advantages provided by this package.

#### \*Main Components of Intranet Technology

SATO Sigeru KAGAMI Toshiro HASEGAWA Yoshiaki

When applying intranet technology to systems that require high speed and reliability, there are many cases that cannot be handled by general-purpose Internet technology alone. Toshiba has developed the network computing terminal (NCT) and the GIGASOLUTION™ middleware package and applied them as major components for systems requiring real-time processing and high reliability.

## Feature Articles

#### \*Satellite 2800 All-In-One Notebook PC for Consumer Use

IWATA Takeshi ITO Hironori

We have developed and introduced the Satellite 2800 three-spindle (HDD, DVD or CD, FDD) retail box on the market. Among the main features of this model are a 15-inch LCD, a DVD-ROM drive, and a maximum HDD capacity of 20 Gbyte.

The Satellite 2800 differs from previous models in its sophisticated industrial design and speaker sound-oriented concept, which were realized through cooperative work with outside designers. The subwoofer has an embedded bass-boost button which emphasizes bass sound. These features significantly differentiate the Satellite 2800 from competitors' models. In addition, the user can play MP3 or CD music without opening the LCD. Needless to say, the controller buttons can also be used to play DVD movies.

#### \*Isotropic SmZrFeN Bonded Magnet Powder with Highest Performance

NAKAGAWA Katsutoshi KAWASHIMA Fumiyuki ARAI Tomohisa

We have developed isotropic SmZrFeCoBN bonded magnet powder with the highest performance of maximum energy product over 160 kJ/m<sup>3</sup>. The magnet powder has a microstructure with a fine and uniform grain size of 10 to 30 nm, which leads to a remanence enhancement effect. The magnet powder also has excellent thermal stability and corrosion resistance. For example, the temperature coefficient of a residual magnetic flux density is less than half that of conventional NdFeB bonded magnet powder.

Bonded magnets employing high-performance SmZrFeCoBN powder are useful for permanent magnet motors applied to micro or mobile electronic equipment which must be compact and lightweight with low power consumption, such as spindle motors for micro hard disk drives. They can also be used for applications requiring high thermal stability or corrosion resistance.