World's First Commercialization of a Mercury-free Silver Oxide Battery

In January 2005, SONY Corporation (Tokyo, Japan) announced the successful commercialization of the world's first mercury-free silver oxide battery, a feat considered difficult within the industry.

There are many types of batteries. Primary (disposable) batteries (such as dry-cell and button batteries) are used once and discarded. Secondary (rechargeable) batteries (which include lithium-ion varieties) can be recharged and used repeatedly. Solar cells represent yet another type of battery. Conventionally, button batteries contain mercury to prevent the generation of hydrogen gas. However, the use of mercury is not without risks. The improper use or disposal of mercury-based batteries carries adverse risks for both the environment and human health. Yet, developing technology necessary to create mercury-free button batteries was an extremely difficult challenge. Sony's commitment to reducing its environmental impact is a reflection of its unrelenting efforts to meet that challenge, and in 2004 it succeeded in developing the world's first mercury-free silver oxide battery. In 2009, Sony achieved what was regarded as an even more difficult task: the development of technology leading to the world's first mercury-free alkaline button battery.

★Why was Mercury Necessary?

★Mercury-free Silver Oxide Button Batteries

★Mercury-free Silver Oxide Technology

---Stepping stone to a mercury-free alkaline button battery

★Future Challenges

Silver Oxide Battery (Mercury-free)
SR626SW

★Why was Mercury Necessary?

Both silver oxide and alkaline batteries (which are the two main types of button batteries) have zinc anodes and an alkaline solution as the electrolyte(Fig.1). Even when the battery is not in use, the zinc in the anode is dissolved by a corrosive reaction with the electrolyte. This reaction also produces hydrogen gas(Fig.2). If hydrogen gas is allowed to build up inside the battery, the resulting internal pressure could cause the battery to swell and leak. Dry-cell batteries are generally large enough to have sufficient space for mechanical measures to deal with this hydrogen gas such as the provision of a safety valve. However, button batteries are simply too small to support such mechanical solutions and even minute amounts of hydrogen gas can cause swelling and leakage.

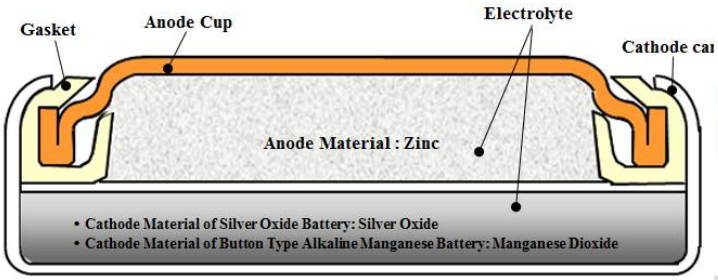


Fig.1: Cross section of button batteries

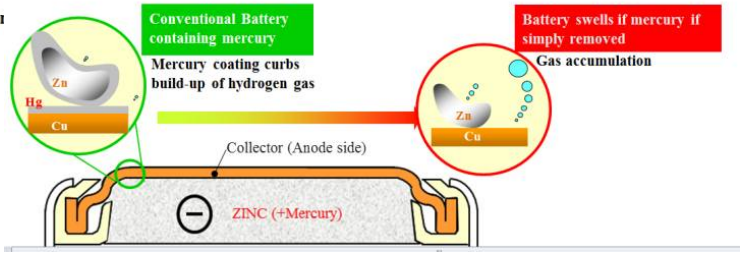


Fig.2: Role of mercury in conventional button batteries

Mercury is widely known for its potential threat to the environment and human health. Such risks can result when improper disposal leads to mercury entering the food chain. Unfortunately, prior to technological advances, conventional button battery manufacturers had no alternative to mercury as a means to curb the build-up of hydrogen gas resulting from the corrosive reaction between mercury and zinc.

The European Battery Directive, which came into effect in 2008, strictly limits the use of mercury in batteries. Because of technical barriers to the development of mercury-free button batteries, button batteries were treated as a special case. As a result, manufacturers are still allowed to use mercury in limited amounts (less than 2%).

★Mercury-free Silver Oxide Button Batteries

The development of mercury-free silver oxide batteries was announced by Sony in 2004. These batteries were created by developing three core technologies to increase the ability of the zinc to resist corrosion. These innovations dramatically reduced the amount of hydrogen gas produced.

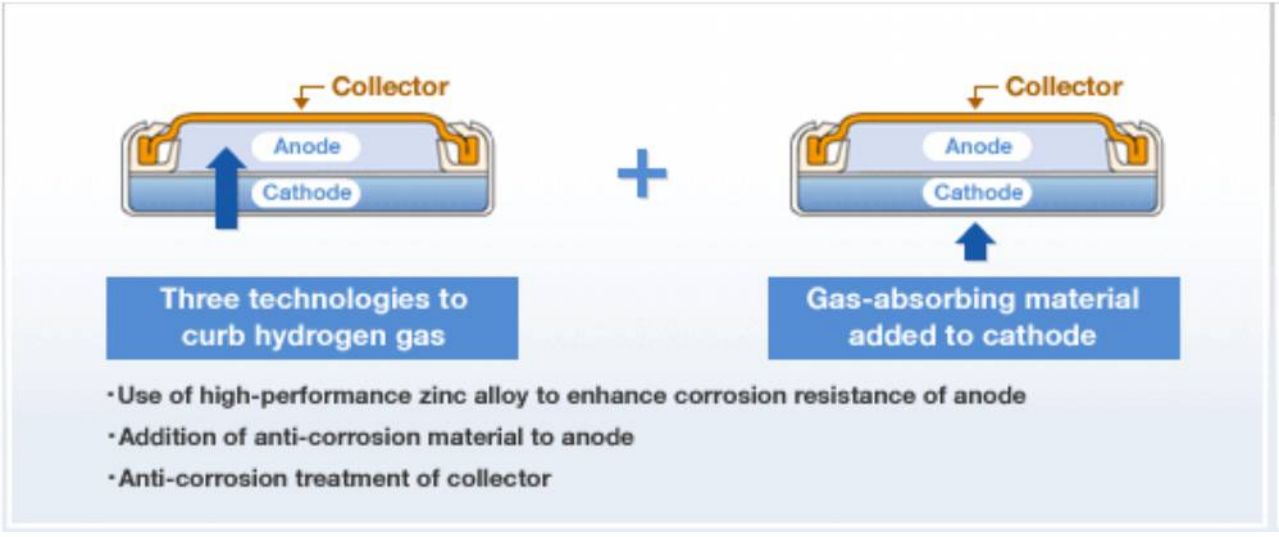
1. Ten-fold improvement in corrosion resistance through use of high-performance zinc alloy in the anode
2. Doubling of corrosion resistance by adding anti-corrosion 2. material to anode
3. Anti-corrosion treatment of collector to prevent electrolyte leakage and reduce zinc corrosion

Sony succeeded in developing a mercury-free battery by using these three unique technologies to achieve a dramatic reduction in hydrogen gas production. Sony also took advantage of the properties of the silver oxide used in the cathode, including its ability to absorb hydrogen gas. This means that even if hydrogen gas is produced, it will simply be absorbed by the silver oxide, making the new battery at least as safe as conventional batteries containing mercury.

★Mercury-free Silver Oxide Technology---Stepping stone to a mercury-free alkaline button battery

The development of a mercury-free alkaline button battery was an even greater challenge, and was initially regarded as impossible in practical terms. Unlike silver oxide batteries, alkaline button batteries contain no substances capable of absorbing hydrogen gas. However, alkaline button batteries are cheaper than silver oxide batteries. Because they are widely used in portable consumer electronics products such as game consoles, toys and other items, they are frequently handled by both adults and children. As Sony began to develop a mercury-free alkaline button battery, its first priority was to ensure safety.

In a silver oxide battery, any hydrogen gas produced is absorbed by the silver oxide. Sony engineers believed it would be possible to develop a safe, mercury-free alkaline button battery if they could find the proper material to perform the same role. This led to intensive research and development efforts focusing on materials with a high capacity to absorb hydrogen gas. By adding a hydrogen-absorbing material to the cathode, and combining this with the three unique technologies developed for the mercury-free silver oxide battery, Sony succeeded in commercializing a mercury-free alkaline button battery that matched or surpassed batteries containing mercury in terms of both safety and performance.



★Future Challenges

Sony sells around 300 million[*1] alkaline button batteries and silver oxide batteries. The development of mercury-free batteries has the potential to reduce the amount of mercury used each year in these two types of batteries by approximately 470kg, or enough to fill approximately 68 clear plastic 500ml beverage bottles[*2]. Sony is dedicated to reducing its carbon footprint via ongoing technological advances. Sony is also dedicated to eliminating all hazardous substances throughout the company's various processes.

※1 Total based on actual shipments of Sony silver oxide batteries (SR) and alkaline button batteries (LR) during fiscal 2008.

※2 Based on Sony research

～Sony's Path to the Development of Mercury-free Batteries～

1977	Sony begins manufacturing silver oxide batteries
1978	Manufacture of alkaline button batteries begins
1982	First lithium button batteries produced
1991	Sony begins manufacturing mercury-free manganese dry-cell batteries.
1992	Manufacture of mercury-free alkaline dry-cell batteries begins.
2004	Sony announces mercury-free silver oxide battery.
2005	Manufacture of mercury-free silver oxide batteries begins.
2009	Sony announces and begins manufacturing mercury-free alkaline button batteries