

Nanosensors and Consumer Products*

Sensor Fabrication, Integration, and Commercialization Workshop

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*This information was prepared by the CPSC staff; it has not been reviewed or approved by, and does not necessarily represent the views of, the Commission.





CPSC Background

- Independent federal regulatory agency, established in 1973, under the Consumer Product Safety Act
- Laws Administered:
 - Consumer Product Safety Act (CPSA)
 - Federal Hazardous Substances Act (FHSA)
 - Flammable Fabrics Act (FFA)
 - Poison Prevention Packaging Act of 1970 (PPPA)
 - Refrigerator Safety Act (RSA)
 - Consumer Product Safety Improvement Act (CPSIA)
 - Gasoline Burn Prevention Act
 - Virginia Graeme Baker Pool and Spa Safety Act



CPSC - Jurisdiction

- Household Cleaners
- Electrical Appliances
- **Electronics**
- Combustion Appliances
- Furniture and Home Accessories
- Sports and Recreational Equipment
- Children's Toys
- Building Materials
- Flammable Fabrics, Materials, and Accessories
- Powered Equipment and Tools
- Child-resistant packaging for pharmaceuticals
- And more...

CPSC National Product Testing & Evaluation Center

Testing Areas



Toy Test Lab



Children's Products Lab



Pool and Spa Products Lab



Impact Lab (Bike Helmets)



General Product Test Lab



Outdoor Power Sports Lab



Electrical Products Test Lab



Chemistry Lab



Combustion Products Test Lab



Modern Conference Space



Machine Shop



Flammability/Fire Test Lab



Sensors and Consumers

Sensors are used in consumer products to make things work and our lives easier.

- Appliances (cooktops, washers, dryers, microwaves)
- Personal devices (mobile phones, laptops, medical devices)

Sensors are used in products today to improve safety.

- Smoke alarms
- **Wearable technology**
- CO alarms
- Burglar alarms
- Gas monitors

How will nano sensors play in role in the future for consumer products?

Nano sensors in consumer products

Personal protection

- Sensors to monitor your health
- Sensors to monitor your surroundings

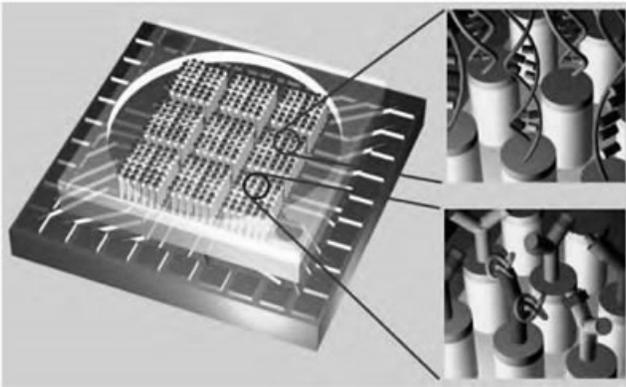
Home protection

- Sensors to monitor integrity
- Sensors to monitor the boundaries
- Sensors to monitor environment



Nanosensors

- Chemical nanosensor that can fit inside a cell phone
 - Detect low concentration of airborne ammonia, chlorine gas, and methane
 - Low-cost, low-power, high-speed sensing
 - Size of a postage stamp



Landslide Victory for Wireless Nanosensors, Institute of Nanotechnology, August 21, 2009

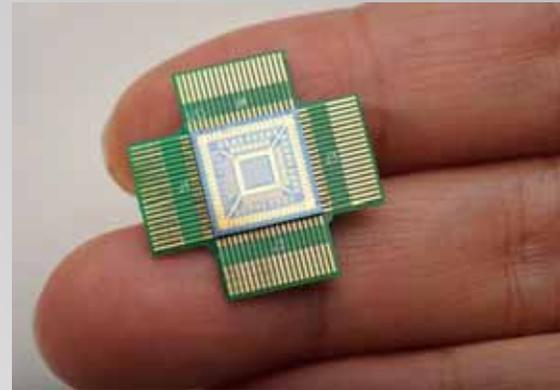


Photo credit: Dominic Hart/NASA, NASA Ames Scientist Develops Cell Phone Chemical Sensor, October 30, 2009

Smoke Alarms (The new era on the horizon)

The standard for smoke alarms will require better detection and less nuisance alarms.



Manufacturers will be forced to shift from standard sensor technology (ionization and photoelectric sensors) to multi-criteria technology.

- Incorporate more sensors for better discrimination
- Explore and use different sensors such as CO, O₂, and CO₂.

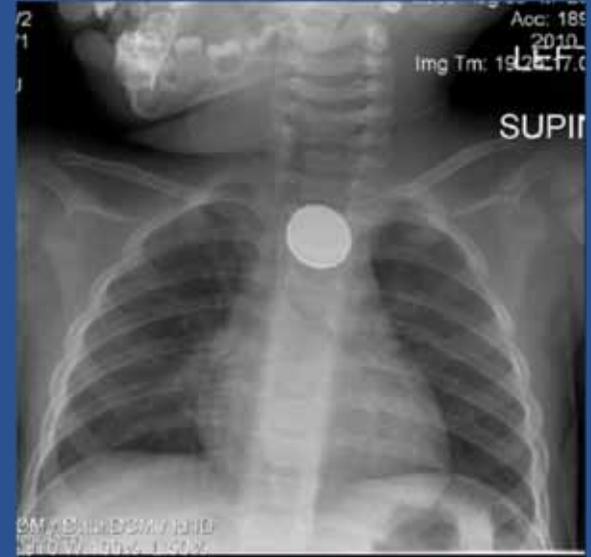


Smoke Alarm Network

- Take a big task and divide it into many smaller tasks
 - Develop smoke detectors (alarms) no larger than a quarter
 - Incorporate the smoke detectors in every possible electronic device
 - Have smoke detectors that monitor their immediate space
 - Communicates with smart smoke alarms in the home
- Collaborate to accomplish the principal goal of reducing fire deaths
 - Working with appliance manufacturers and smoke alarm manufacturers to achieve the same goal
 - Develop standardized protocol and communication to bridge partnerships effectively
- Benefits all participants
 - Consumers are given a bigger and finer safety net
 - Promotes innovations for manufacturers
 - Allure of a safer products for the consumer through partnerships between all participants

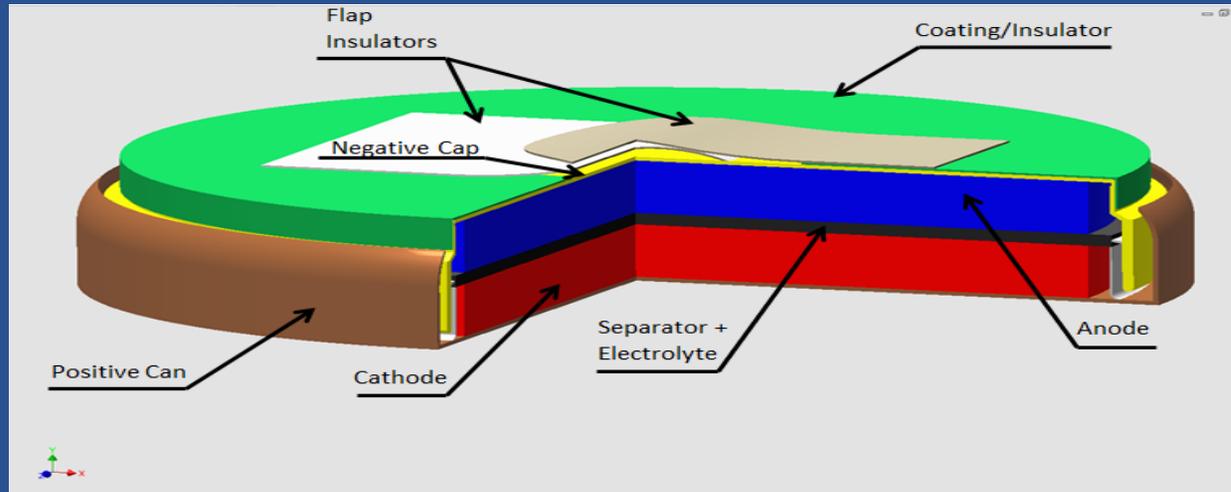
Button/Coin Cell Battery Ingestion Hazard

- Button/coin cell batteries lodged in the esophagus can cause electrical current to hydrolyze fluid, leading to hydroxide burns.
- Can lead to severe injuries and death in as little as 2 hours
 - Victims can present nonspecific flu-like symptoms
 - Delayed treatment causes fistulas, perforations, necrosis, stricture, and vocal cord paralysis.



Cell Modification Concepts

Insulating One of the Terminals



- Coat/insulate one terminal
- Reduce likelihood of contact and conduction between both poles

Potential Safety Solution

- Develop coating
 - Applied to one terminal
 - Conductive when dry
 - Insulator when exposed to moisture/saliva
- Does nanotechnology offer a potential solution to address this hazard?



Acceptance for manufacturers

Reliable – The sensor must be reliable to avoid false tripping and drifting over time.

Low cost – To be competitive in the industry, the sensor must not significantly increase the base price of the product.

Implementation – The sensor must be easy to implement, such as standard power, pin configuration, and hardware.

Maintenance – The sensor must be low or no maintenance for the manufacturer and the end customer.



CPSC Information

- CPSC Website
 - www.cpsc.gov
- Chronic Hazard Guidelines
 - www.cpsc.gov/BUSINFO/chronic.pdf
- CPSC Product Safety Database Website
 - www.saferproducts.gov
- Treye Thomas
 - tthomas@cpsc.gov
- Neal Cohen
 - Small Business Ombudsman
 - (888) 531-9070