

New Japan-made materials that have changed the world

Smartphones, computers, and gasoline, electric, and hybrid vehicles are commonplace things we use every day. The fact that they have become so pervasive and convenient can be attributed to the emergence of unprecedented high-performance component materials that have improved convenience, safety, and reliability. Many of these materials were discovered and developed by researchers and companies in Japan.

The basic constituents of these materials are chemical elements. By combining the inherent properties of these elements, a wide variety of materials can be created. The types and quantities of elements being used have increased markedly in recent years. High-performance component materials in particular use large amounts of critical materials with low production or availability.

Researcher affiliations are those at the time of the announcement. Titles have been omitted. Precious metals and rare-earth elements in the compositions are indicated in the column-shaped icons.



Neodymium magnets



rare-earth element
(neodymium and so on)

Masato Sagawa
(Sumitomo Special Metals
Co., Ltd., 1982)
Neodymium magnets possess
ten times the magnetic energy of
conventional ferrite mag-
nets.



Vibrator for a smartphone



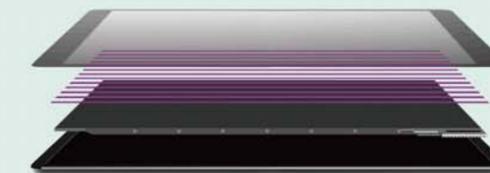
Drive motor for an automobile

IGZO amorphous oxide semiconductors



indium gallium zinc

Hideo Hosono (Tokyo Institute of Technology, 2004)
IGZO has become widely used in high-resolution displays due to its
low power consumption and an electron mobility several tens of
times that of conventional amorphous silicon.



Smartphone display

Lithium-ion batteries



lithium cobalt

Akira Yoshino (Asahi Kasei Corporation, 1985)
Li-ion batteries have about three times the energy density as nick-
el-metal hydride batteries.



Batteries for driving automobiles

Blue LEDs



gallium

Isamu Akasaki and Hiroshi Amano
(Nagoya University, 1989) and Shuji
Nakamura (Nichia Corporation)
The development of blue LEDs, togeth-
er with the existing red and green
LEDs, completed the full set of primary
colors, allowing for the expression of all
colors and a wide variety of uses.



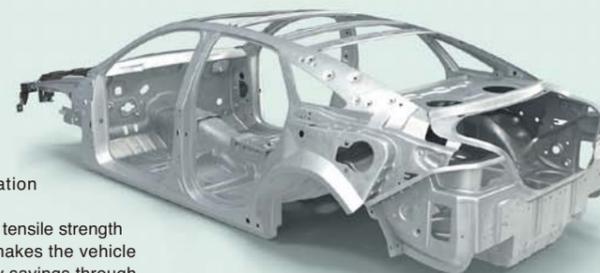
In car headlights, blue LED light incident on yellow
or other phosphor generates a bright white light.

High tensile strength steel sheets



manganese nickel niobium

Developed in the mid-1970s by
Japanese steel makers in collaboration
with the Japanese automotive industry.
The steel sheets have about twice the tensile strength
of conventional steel sheets, which makes the vehicle
parts lighter and contributes to energy savings through
better mileage.



Vehicle frame

Three-way catalysts for vehicle emissions



rhodium palladium platinum

Japan's automobile manufacturers
developed a practical system in the
mid-1970s
for simultaneously removing the
harmful components nitrogen oxides
(NOx), hydrocarbons (HC), and
carbon monoxide (CO) from exhaust
gas.



Catalytic Converter for a car