

High Material Issue 06

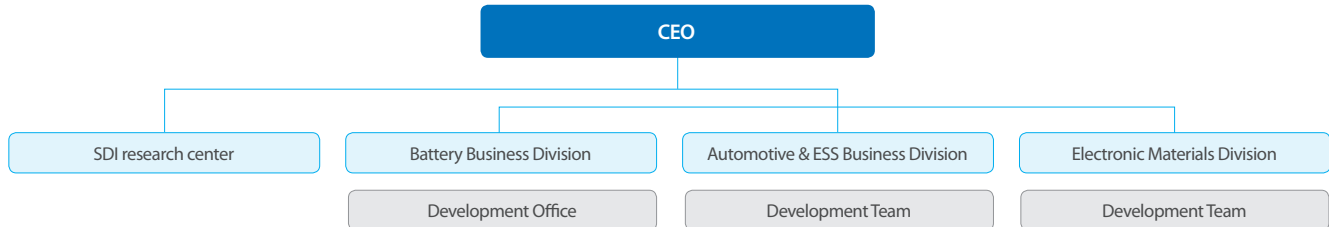
Enhancement of R&D Capability

The slowdown in the global economy coupled with the growing protectionism require more competitive products and services. Samsung SDI strives to better satisfy our customers by developing new technologies and innovations to obtain the future growth momentums in its battery business.

Organization Operation

Samsung SDI runs a research center under the direct supervision of the CEO to improve efficiency of the research organization and to build the foundations for improved performances. In addition, development teams at each business division are doing research and development for 'Battery Business', 'Automotive and ESS' and 'Electronic Materials Business' sharing the same vision of procuring the top materials and enhancing the product competitiveness.

R&D Organization Map



The 24% of its employees are assigned to research and development and we support them to exert their best abilities.

Open Innovation

Samsung SDI expands industrial-academic cooperation to obtain the next-generation battery technologies and increase the base for battery research. In 2016, we concluded industrial-academic cooperation programs with four universities in Korea to contribute to active exchanges between universities and the industry. We expect that these programs will converge excellent research capability of the universities and Samsung SDI's experience and technologies to provide opportunities to develop innovative battery technologies in addition to training superior talents.

Patent Competitiveness

Supporting SDI research center and individual business departments in the field of patent business to reinforce the company's intellectual property competency and pioneering next-generation business areas. As of 2016, the company has 4,273 patents in Korea, and 7,613 patents in major overseas markets such as the United States, China, Japan, etc and

patent portfolio optimization is conducted through evaluating the patent which reflects technical trends. Samsung SDI strives to secure R&D competencies through filling, registering and maintaining the patents and to protect and achieve mutual growths with partner companies by co-ownership of patents.

Especially, we have various patent compensation systems for promotion and focus on obtaining excellent patents with these systems.

Major R&D Performance

Major R&D Performance	Research Performance and Estimated Impacts
Developed gap-filling tape for protection of electrode assembly of cylindrical secondary batteries	Improved vibration resistance by fixing and protecting internal components of batteries (jelly roll)
Developed the cylindrical case for xEV lithium-ion batteries	Developed cases specialized for EV batteries to improve K52 safety and reliability
Developed high-luminance CR	Maintained the existing market share by developing products with better luminance
Developed high efficiency electrode paste	Secured sales increase base by developing high efficiency electrode paste
Developed the next-generation polarizing films	Expanded product portfolio by developing polarizing films applicable to new display products
Developed OLED deposition materials	Entered new markets by developing high efficiency and long-lasting deposition materials
Developed slurry for semiconductors	Increased market share by developing new products
Developed EMC for semiconductors	Increased market share by developing EMC which has superior void characteristics

BUSINESS CASE



Automotive Batteries

The battery industry is expected to grow at the high rate as the electric vehicle market started to expand. Samsung SDI developed PHEV cell/module for European OEM in 2016 and will begin mass production in 2017. In addition, we are developing batteries for a number of electric vehicles with other global major OEMs, leading the expansion of eco-friendly electric vehicle market for the future.



Electronic Materials

'OLED' is the hottest topic in the recent display industry. As the global smartphone manufacturers including Samsung Electronics and Apple announced to adopt OLED display for their devices, the market is expected to grow further. Samsung SDI successfully developed phosphorescence Green Host, OLED luminescent material, in 2014 and advanced materials, which have high efficiency and drive voltages, in 2016 to contribute to realizing eco-friendly/low-energy smartphones.

Enhancement of R&D Capability

Input



Financial Capital

R&D Investment	Unit	2014	2015	2016
Investment	KRW 100 million	6,205	5,389	5,525
Investment / Revenue	%	7.4	10.9	10.6



Human Capital

Training R&D Resources	Unit	2016
R&D staff	Persons	2,174
R&D staff / Total employee	%	24
R&D training course	EA	374
R&D training cost	KRW million	224

Output



Intellectual Capital

Patent Registration	Unit	2014	2015	2016
Korea	Case	6,339	4,770	4,273
U.S.	Case	2,630	2,044	2,702
China	Case	1,578	1,380	1,392
Japan	Case	1,533	1,307	1,127
Europe	Case	2,147	735	1,812
Other	Case	441	498	580
Total	Case	14,668	10,734	11,886