

Galaxy Note 7 recall shows challenges of stronger batteries

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In this Sept. 8, 2016 file photo, a Samsung Electronics' Galaxy Note 7 smartphone is displayed at the headquarters of South Korean mobile carrier KT in Seoul, South Korea. Samsung's recall of 2.5 million Galaxy Note 7 phones after several dozen caught fire and exploded may stem from a subtle manufacturing error, but it highlights the challenge electronics makers face in packing ever more battery power into ever thinner phones, while rushing for faster release dates. (AP Photo/Ahn Young-joon, File)

Samsung's recall of 2.5 million Galaxy Note 7 phones after several dozen caught fire and exploded may stem from a subtle manufacturing error, but it highlights the challenge electronics makers face in packing ever more battery power into ever thinner phones, while rushing for faster release dates.

Announcing the recall on Sept. 2, Samsung confirmed dozens of cases where Note 7 batteries caught fire or exploded, mostly while charging. It plans a software update that will cap battery recharging at 60 percent capacity to help minimize risks of overheating. But it is urging owners to keep the phones turned off until they can get them replaced, beginning Monday.

U.S. safety regulators stepped in Thursday with an official recall, saying Samsung's voluntary efforts were inadequate. Though Samsung promised replacement devices, the U.S. Consumer Product Safety Commission said U.S. customers would be eligible for refunds if they choose. Replacements are expected in stores by next Wednesday.

The Note 7 debuted to rave reviews in August thanks to its speed, new software features and—not least—the estimated nine hours it would run between charges. But all that power comes at a price: Users began reporting the phones were catching fire or exploding, in one case incinerating the SUV it had been left in.

Aviation authorities in the U.S., Australia and Europe have urged passengers not to use or charge Note 7s while flying and not to put them in checked baggage. On Monday, Canada issued an official recall.

Koh Dong-jin, Samsung's mobile president, said in announcing the recall on Sept. 2 that an investigation turned up a "tiny error" in the manufacturing process for the faulty batteries in the Note 7s that was very difficult to identify. The end of the pouch-shaped battery cell had

some flaws that increased the chance of stress or overheating, he explained.

That kind of manufacturing error is unimaginable for top-notch battery makers with adequate quality controls, said Park Chul Wan, a former director of the next generation battery research center at the state-owned Korea Electronics Technology Institute.

Samsung and other experts should search for factors outside the battery cells that could have led to overheating, he said.

"If Koh's argument is right, that makes Samsung SDI a third-rate company," Park said. "But it does not appear to be a simple battery problem."

Time also is a factor in marketing and making the phones.

In 2015, Samsung moved up its unveiling of its new Galaxy Note model to August from September, seeking a leg up on Apple's September iPhone upgrades.

Before the issue of battery explosions emerged, supplies were not keeping pace with demand for the Note 7.



In this Sept. 11, 2016 file photo, powered-off Samsung Electronics Galaxy Note 7 smartphones are displayed at the company's service center in Seoul, South Korea. Samsung's recall of 2.5 million Galaxy Note 7 phones after several dozen caught fire and exploded may stem from a subtle manufacturing error, but it highlights the challenge electronics makers face in packing ever more battery power into ever thinner phones, while rushing for faster release dates. (AP Photo/Ahn Young-joon, File)

Samsung has not recalled Note 7s sold in China, but the company has refused to say which of its two battery suppliers made the faulty batteries or clarify whose batteries are used in which Note 7 smartphones. The company also refused comment on South Korean media reports that it has stopped using batteries from Samsung SDI, one of its two suppliers, in the Note 7.

C.W. Chung, an analyst at Nomura Securities in Seoul, cited SDI officials in estimating that about 70 percent of the batteries for the

Galaxy Note 7 smartphones came from SDI.

The other 30 percent are thought to have been supplied by Amperex Technology Ltd., a Chinese-based manufacturer that reportedly also is a main supplier of batteries for the iPhone.

Problems with lithium batteries have afflicted everything from laptops to Tesla cars to Boeing's 787 jetliner, though having so many lithium-ion battery fires in a short time is unheard of, Park said.

The batteries are ubiquitous in consumer electronic devices, favored by manufacturers because they are lightweight and pack much more energy into a small space than other power cells.

But storing so much energy in a tiny space, with combustible components separated by ultra-thin walls, makes them susceptible to overheating if exposed to high temperatures, damage or flaws in manufacturing. If the separators fail, a chemical reaction can quickly escalate out of control.

That's what happened with the Note 7, Samsung's Koh explained.

"The flaw in the manufacturing process resulted in the negative electrodes and the positive electrodes coming together," he told reporters in Seoul.

It is unclear how Samsung failed to discover the battery problem before launching the Note 7. It confirmed delays in shipments for extra quality tests weeks later, in late August, after photos of charred phones began popping up on social media.

South Korean experts suggested Samsung may have been so ambitious with the Note 7's design that it compromised safety.

"There was no choice but to make the separator (between positive and negative anodes) thin because of the battery capacity," said Lee Sang-yong, a professor at Ulsan National Institute of Science and Technology who worked more than a decade at LG Chem, a leading lithium battery maker. Thicker separators can improve safety but will not necessarily prevent all overheating issues, he said.

Doh Chil-Hoon, head of the state-run Korea Electrotechnology Research Institute's battery research division, said that based on the limited information provided by Samsung, he believes the push to increase battery power was part of the problem.



In this Sept. 2, 2016 file photo, Koh Dong-jin, president of Samsung Electronics' mobile business, speaks at a news conference in Seoul. Samsung's recall of 2.5 million Galaxy Note 7 phones after several dozen caught fire and exploded may stem from a subtle manufacturing error, but it highlights the challenge electronics makers face in packing ever more battery power into ever thinner

phones, while rushing for faster release dates. (Kim Hong-Ji/Pool Photo via AP, File)

"Even with a small manufacturing mistake, if there had been enough elements to ensure safety, it would not explode," Doh said. "It is a roundabout way of admitting weak safety."

The Note 7 phones have a powerful 3,500 milliampere hour battery, whereas the Galaxy S7 smartphone, which has a slightly smaller body than the Note 7, features a 3,000 mAh battery. So does the Note 5, launched in 2015.

Apple does not provide information on the iPhone's battery capacity in milliampere hours. But two research firms that specialize in analyzing tech gadgets and their components said the battery in the iPhone 6S Plus is 2,750mAh. The size of the battery in the newly released iPhone 7 is not yet known.

The 3,500 mAh battery in the Samsung Note 7 is "one of the highest, if not the highest, capacity battery we've seen in a phone," said Wayne Lam, an industry analyst at IHS Markit Technology.

Lam said he thinks the Note 7 battery problem resulted from weak controls in manufacturing, not a poor or unsafe design.

A spokeswoman at iFixit, which publishes repair guides for electronic gadgets, offered a similar view. "We don't think any internal design changes in the Note 7 are responsible for the exploding batteries—more likely just a manufacturing defect," iFixit's Kay-Kay Clapp said in an email.

Apple has tweaked hardware and software it developed itself to make iPhones use power more efficiently, while Samsung has increased the capacity of the batteries in its phones.

That can be done without increasing size by adjusting components or changing the production process, Lam said.

"You have two different trajectories, with Samsung packing in more energy density, versus Apple trying to trim it down by optimizing everything else," he said, adding that the two rivals are "constantly locked in this arms race of improving and one-upping."

While Apple and Samsung are using built-in batteries for their premium phones, LG Electronics, Samsung's smaller South Korean rival, has opted for a replaceable, 3,200 mAh capacity battery for its new premium, jumbo screen smartphone, the V20.

LG chose to make the phone thinner and allow customers to extend battery life by swapping out batteries.

"The security of the battery isn't directly related to whether the battery is replaceable or not," Cho Joon-ho, head of LG's mobile business, told reporters. "But we make efforts to secure safety with quality controlling tests beforehand."

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