

# Elements of smartphones

At least 70 of the naturally occurring chemical elements are used in the manufacture of smartphones (Figure 1)

H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Nh	Fl	Mc	Lv	Ts	Og
		Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu		
		Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr		

Figure 1 Elements used in smartphones



## Tough touchscreen

Alkali-aluminosilicate glass with indium tin oxide coating (a thin transparent layer) over the top (capacitive Gorilla glass). The colours are due to small amounts of rare earths, such as praseodymium, terbium, yttrium, gadolinium (in fact all but the radioactive rare earths are involved).

The alkali-aluminosilicate glass is ordinary sodium-aluminosilicate dipped in a hot solution of potassium salt, which allows replacement of sodium with potassium, thus compressing and strengthening the glass.

## LCDs

Liquid crystal displays (LCDs) require a backlight to function, with the liquid crystals producing electrically induced patterns letting the light through, creating the colours and shapes on the screen. LED (light-emitting diode) or even AMOLED (active-matrix organic LED) technology has been introduced to allow production of light in every individual pixel — 'proper' black is then possible by simply switching off the pixel.

## Camera

Boron in the lens, with silicates, but also in the chip. Rare earth elements in the lens — often the lens is made of plastic because that can be moulded easily.

## System-on-a-chip (SoC)

Contains processors and certain sensors: copper, silicon, gold, silver, boron and other metals, including hafnium to prevent current leaks.

## Long-life battery

Commonly a lithium-ion battery encased in aluminium. Positive electrode made up of layers of lithium cobalt oxide, carbon (graphite) negative electrode. Lithium ions move from positive to negative electrode during use, and flow in reverse during charging.

## Casing and cover

Aluminium, rubber, plastic.

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