

MINERALS IN AN ELECTRIC CAR

WHAT ARE ELECTRIC CARS?

Electric cars, sometimes called electric vehicles or EVs, are cars that run on electricity rather than on fuels like petrol or diesel. Electric cars rely on a battery-powered electric motor that is charged by electricity.

The good thing about electric cars is that they release less carbon dioxide into the atmosphere. Electric cars are also much more efficient than combustion engine cars which means less energy is wasted as heat. Switching more of our vehicles to electric vehicles is one way we can reduce the amount of carbon dioxide we are releasing into the atmosphere and help to slow down climate change.

The demand for electric cars is increasing every year, but manufacturing electric cars requires lots of different minerals and metals. It's extremely important that all the resources needed to make electric cars are sourced and mined responsibly and that recycled materials are used where possible instead. Mines can have large environmental and social impacts that need to be carefully managed to protect water, habitats, soil and local communities.

SPODUMENE: LITHIUM

Chemical formula: $\text{LiAl}(\text{SiO}_3)_2$

Lithium is a soft silvery-white metal. It can be found in the minerals spodumene, petalite and lepidolite as well as in lithium chloride salts in brine pools and in hot groundwater (geothermal).

Lithium is one of the most important metals used in an electric car because it is used in lithium-ion batteries, the rechargeable batteries found in almost all electric cars. These batteries can hold a lot of power whilst taking up little space, have high heat resistance and a long life span.

CHALCOPYRITE: COPPER

Chemical formula: CuFeS_2

Copper is a brownish-red, shiny metal that is very good at conducting heat and electricity. Most of the copper we use comes from the mineral chalcopyrite. However we can also find copper in its 'elemental form', which means finding the copper as a lump of metal rather than within another mineral.

Because it is so good at conducting electricity and also very bendy, copper is ideal for all the electrical wiring needed in an electric car. In fact, one electric car can contain over a mile of copper wiring! Copper is also used in the motor coil which drives the engine, in the inverter, batteries and also in electric car charging stations.

BAUXITE: ALUMINIUM

Chemical formula: $\text{Al}(\text{OH})_3$ or $\text{AlO}(\text{OH})$

Aluminium is a silvery-white, lightweight metal. It is very durable, good at conducting heat and easy to shape so it has a wide range of uses. Aluminium is the most common metal in the Earth's crust. Most of the aluminium we use is mined in the form of bauxite, which is a rock composed mainly of iron oxides and aluminium-bearing minerals such as gibbsite.

Aluminium is used to case the battery pack in an electric car. It's very good at conducting heat which helps the battery stay cool and it lasts a long time without deteriorating (for example iron would rust) as well as not adding too much weight to the car. Aluminium can also be used to replace other metals and materials that would be used in a typical combustion engine car. This helps to reduce the overall weight of the electric car, making it more energy efficient and able to travel longer distances on one battery charge. Because of this, electric cars on average use about 25% more aluminium than cars with combustion engines.

Most of the aluminium used in electric cars is fully recyclable which means it can be used again and again for different purposes. This could help to make the electric car industry more sustainable. Instead of always mining for new aluminium, which requires a lot of energy, it can be recycled from older cars and other sources.

GRAPHITE: CARBON

Chemical formula: C

There are two main forms of pure carbon naturally occurring on Earth - graphite and diamond. Graphite is a soft, slippery solid that can be found in metamorphic rocks, igneous rocks and in meteorites.

Graphite conducts electricity and is heat resistant. It is used as a negative electrode in electric car rechargeable batteries. Carbon fibre is a synthetic (manufactured by people) form of graphite that is very strong and incredibly lightweight. Carbon fibre can be used to reinforce the chassis (base frame) and the body panels in an electric car.

Because of its soft and slippery properties, graphite is the material we use to make pencil leads.

LIMONITE: NICKEL

Chemical formula: $\text{FeO}(\text{OH}) \cdot n\text{H}_2\text{O}$

Nickel is a silvery-white metal which is very ductile (stretchable) and has a high melting point. Nickel comes from two main sources. It can be found in sulphide minerals like pentlandite and chalcopyrite (an important mineral for copper), or it can be found in deposits known as laterites. Laterites are soft clay-like minerals. Limonite is the name of a combination of minerals often found in laterites that are rich in nickel and iron.

Nickel is used in lithium-ion batteries to increase their energy density - it helps the batteries store more energy in a smaller amount of space and means that the cars can drive for longer before needing to recharge.

Nickel is also used in nickel-metal hydride batteries which are mostly used in hybrid electric cars, rather than purely electric cars. These batteries are currently very expensive to produce as they also contain rare earth elements like neodymium and lanthanum.

HEMATITE: IRON

Chemical formula: Fe_2O_3

Iron is a shiny grey metal which comes from iron ore - a combination of minerals or a material that contains a lot of metallic iron. Common types of iron minerals are hematite, magnetite and goethite.

Iron is combined with carbon as well as other metals like tungsten, nickel, manganese and chromium, to make steel. Steel is extremely strong, resistant to rusting and relatively cheap. It is used in lots of different parts of an electric car including the electric motor, the car body, the door panels and the wheel rims.

COBALTITE: COBALT

Chemical formula: CoAsS

Cobalt is a silvery-blue, magnetic metal. Most of the cobalt we use comes as a by-product from large scale copper and nickel mining or from the minerals cobaltite, smaltite and erythrite.

Cobalt is a critical component in most lithium-ion batteries as it is used to make the positive anode in the battery. Cobalt is very stable and has a long-life cycle which allows the batteries to be charged and drained numerous times before showing any signs of wearing out.

However, some Cobalt mining has been linked with human rights abuses and very unsafe working conditions. It is important that cobalt in electric vehicles is extracted safely, carefully considering both working conditions and the environment.

RUTILE: TITANIUM

Chemical formula: TiO_2

Titanium is a hard strong metal that is very lightweight and very heat resistant. We get most of our titanium from the minerals rutile and ilmenite, although it does occur in small amounts in almost every type of igneous rock.

Titanium is a very expensive material so it's usually the more highly priced electric cars that contain titanium. Titanium can be used in the frames and casings of electric car batteries to protect them from damage and from overheating. Titanium can also be used in parts of the electric motor because it is reliable and durable at high temperatures. The chassis and body panels of electric cars can also use titanium in place of heavier materials, making the car lighter and more energy efficient.



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