GREEN MAGNETIZABLE CONCRETE FOR WIRELESS ELECTRIC VEHICLE CHARGING

INTRODUCTION

Worldwide the adoption of electric vehicles (EVs) is gaining pace, bringing the charging infrastructure into focus. So far charge points for EVs have been plug-in solutions, which work but are not very convenient. More recently fast charging plug-ins have been introduced, which currently represent only a few percent of the installed base. The next step in the evolution of EV charging is wireless charging, which is perceived as an enabling technology for Autonomous (self-driving) Vehicles.

APPLICATIONS

Wireless charging of EVs is a simple promising emerging technology:

1. Electricity from the grid is sends current through the transmitter coil
2. The current generates a magnetic field
3. The magnetic field induces current in the receiving coil, which is tuned to the same frequency

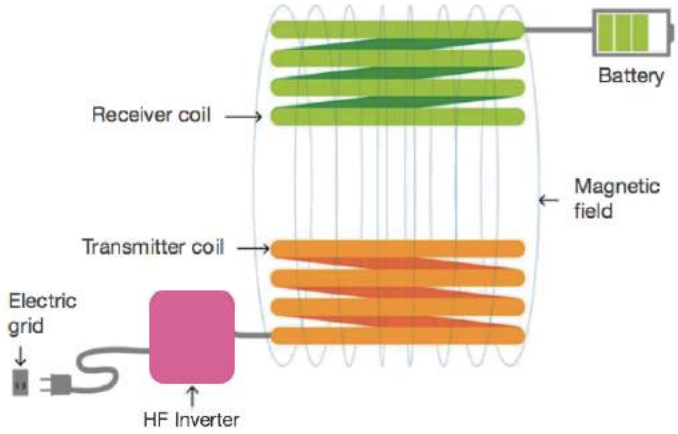


Figure 1. Wireless charging*

A handful of companies offer commercial solutions for static charging, while the vehicle is parked.

* Courtesy of VOX MAGAZINE. www.vox.com

Figure 2. EV charge in motion

However, wireless charging holds its biggest promise in dynamic charging, while the vehicle is in motion.

In order to do wireless charging of EVs at high efficiency a focused magnetic field is required between transmitter and receiver, which necessitates a high permeability of the primary coil substrate.

Figure 3. EV charging

The conventional approach is to do this with ceramic ferrite components. Due to the size of the primary coil (up to several meters) and the fact that ferrite is brittle, this is an expensive and impractical solution.

Plastoferrites are not an option either because they are also way expensive as compared to cement-bonded components, have lower permeabilities and would not be dimensionally stable at high temperatures. All other soft magnetic materials (metal powder or amorphous metals) do not come into consideration due to high costs and limitations with respect to the size of the component. This also applies to composite materials based on these materials.

OUR SOLUTION

A new material has been developed, which is a magnetizable concrete called Magment.

This patented material has the mechanical properties of concrete, thus making it durable and compatible with materials currently used in road surfaces. It can be equally used for both static and dynamic charging. The advantage lies in the versatile shaping of the substrate to maximise transmission efficiency.

The material can be also used for the receiver in the vehicle due to its low density, hence the substrate's weight.

Figure 4. MAGMENT production process

Its magnetic behaviour is similar to ceramic ferrite. Although the permeability (μ) of Magment is lower than of ceramic ferrite, tests have demonstrated that virtually the same power transfer efficiency can be achieved for the same geometry. However, with a suitable structure efficiency is even higher.

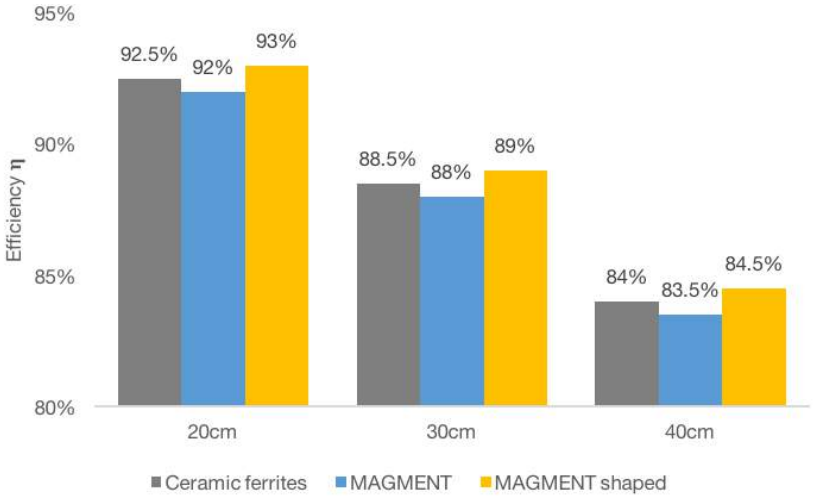
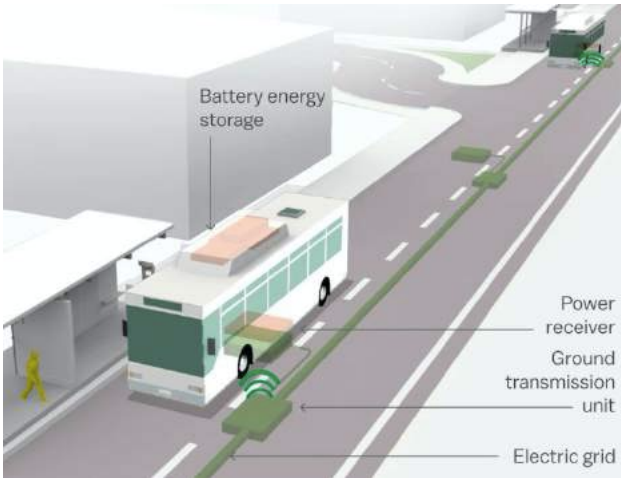


Figure 5. Transmitter-pickup coil distance for different electrical vehicles

MAGMENT: ENVIRONMENTALLY FRIENDLY AND EASY TO USE

The magnetic properties of Magment are generated by ferrite particles used as magnetic filler in the concrete matrix. These ferrite particles are obtained from recycled material from the ferrite industry and from the rapidly growing mount of electronic waste.

Just like normal concrete Magment can be supplied in pre-cast structured panels (See Fig. 4) or cast in situ. There is no need to apply pressure. This makes the application of Magment fully compatible with conventional road construction practices.



VERSATILITY

The load bearing properties of Magment make it suitable not only for wireless charging of passenger cars, but also of busses, vans and lorries.

Figure 6. Public transportation wireless charging**

** Courtesy of VOX MAGAZINE. www.vox.com