Maglev to copper coils

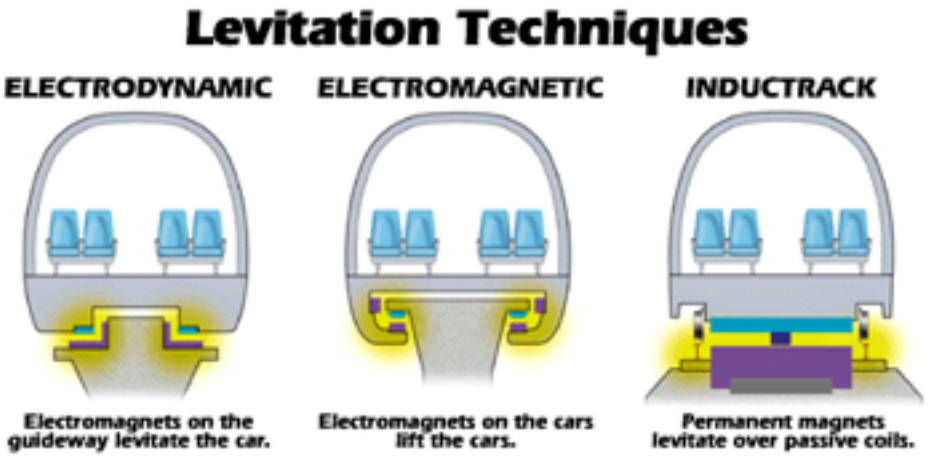
Maglev is a very complex subject, with limited published information.
Apologies for any possible inaccuracies.

Maglev's potential for Hyperloop

There is little doubt that Maglev would work well for Hyperloop's proposed high speeds. The lack of any mechanical contact and friction is big advantage.

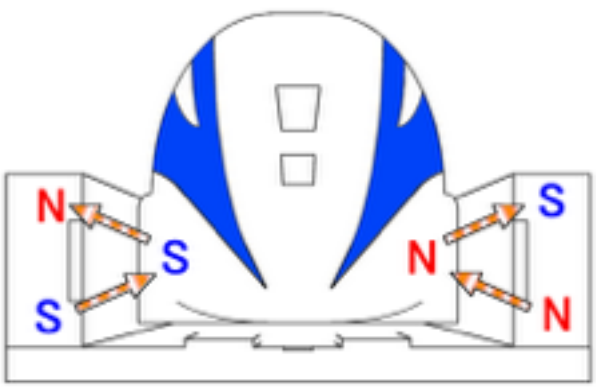
But extreme expense has always been the barrier to widespread adoption of maglev for high-speed transportation. Added to the expense of the vacuum tube, it would seem unlikely that a maglev Hyperloop would ever be economically viable. Economics is not just about making more profit, if the high capital expenses discourages anyone from building it, the project will fail.

Maglev is a very mature technology, with a high level of research over the last 40 years, directed towards high-speed transportation. It is unlikely that Hyperloop-specific research will discover any magic formula to reduce the prohibitive costs.



Maglev is free of mechanical friction, but energy is lost in other ways, mainly eddy current drag. Inductrack claims a lift/drag ratio up to 200:1, which is slightly better than low rolling resistance car tires, about 140:1, but not as good as steel railway wheels at 500:1

ElectroDynamic Suspension, SCMaglev.

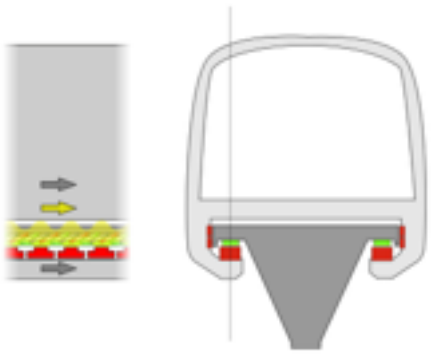


EDS is is the principle used by the experimental Japanese SCMaglev train. The train has superconductor magnets which are super-cooled. When moving fast enough, the magnets induce current in coils in the walls of the track. These are arranged to provide a combination of repulsion and attraction for levitation and stability. There has been a number of different arrangements of the coils over the years of development.

This system is dynamically stable, and requires no feedback for positioning. EDS has no lift at low speeds, so wheels are necessary.

The SCMaglev has never progressed to passenger service, but it has achieved the fastest speed of any maglev system, 603 km/h (375 mph) in 2015.

ElectroMagnetic Suspension, Transrapid.



The Shanghai Transrapid train, the only high-speed maglev in service, with a 30km track.

EMS is used by the Transrapid train, and uses magnetic attraction for levitation. It uses coils in the track, which are attracted to the underhung coils on the train. Attraction is basically unstable, and requires rapid switching in response to position sensors. The track needs to be extremely accurate.

Because EMS works when stationary, no wheels are required on the train.

This is the only functional high-speed system in the world, in Shanghai, built by Transrapid in Munich, Germany. It is a 30 km track, with a maximum speed of 430 km/h. But it only averages 230 km/h, maybe due to acceleration and cornering limitations. Proposals to extend the maglev into Shanghai have been rejected due to the high cost.