

Eddy currents

More Details

Induction and Lenz's law

This experiment is based on one of the most fundamental laws of physics, the law of induction: Whenever a conductive material moves through a magnetic field, a current is induced in it, i.e. a current begins to flow. Without knowing the exact processes, thanks to the rule of the Baltic physicist Heinrich Lenz, one can immediately explain what happens here:

"The induction current is always directed in such a way that it tries to inhibit the cause of its creation".

In our experiment, the cause of the current is the movement of the disc – so the disc is slowed down by the induced eddy currents. This also means, however, that the disc can never be completely slowed down: The moment the disc comes to a standstill, the cause of the eddy currents has disappeared and the disc immediately begins to fall again.

Eddy currents in railway tracks

Why do Intercity Express trains have such a soft and smooth start, while most regional trains are jolted through with a lot of jerking? The explanation: the Intercity Express trains have been running with eddy current brakes since the end of the 1990s. Because they brake contact-free and the braking effect is infinitely variable via electromagnets, jerking and squeaking are a thing of the past. The contact-free braking has another unbeatable advantage: no more replacing of worn brake

pads! Nevertheless, eddy-current brakes must always be combined with a normal brake because they can never bring a train to a complete stop (see above).

The braking effect is particularly enormous at high speeds. It is also absolutely reliable when there is snow or wet leaves on the rails. Although the brakes do not touch the rails or wheels, the rails are heated: the energy from the movement of the train must disappear somewhere. On busy tracks, this can cause the rails to heat up by an average of about 15°C.

Eddy-current brakes – not only on trains

As early as 1892, clever inventors developed eddy current brakes, but this type of brake only became established in more recent times. Other than in Intercity Express trains, they are used in trucks and roller coasters. They are most common in measuring devices, but also in exercise bikes, where eddy current brakes can be used to adjust the resistance.