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RATIONAL CHOICE OF FLYWHEEL MATERIAL

Flywheel energy storage devices are mechanical systems that store kinetic energy through the inertia of a rotating solid body. For many decades, they have proven to be a reliable means of energy storage and of smoothing out energy

fluctuations due to their structural simplicity and high reliability. The undeniable advantages of flywheels over other types of energy storage devices include technological simplicity, high durability, high efficiency, the ability to rapidly store and release energy, insensitivity to the number of charge-discharge cycles, and environmental safety.

However, with the advent of modern chemical energy sources, flywheels have become inferior in terms of specific energy capacity (5–150 Wh/kg vs. 100–265 Wh/kg) [1]. Practical implementation of flywheels is often limited by the technological constraints of most materials: specific strength (strength-to-density ratio) [2-3]. These factors significantly narrow the scope for effective design solutions.

The authors' analysis of the rationality of using high-strength steels, aluminum and titanium alloys revealed that some of these materials demonstrate a promising balance of specific strength (σ/ρ) and cost. Consideration of economic aspects confirmed that the materials can be technologically and economically justified depending on the target parameters of the device.

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