

Diy lithium batteries how to build your own battery packs

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Many a hacker has looked at their scooter, bike, or skateboard, and decided that it would be even better if only it had a motor on it. Setting out to electrify one's personal transport can be an exciting and productive journey, and one that promises to teach many lessons about mechanical and electronic engineering. Fundamentally, the key to any build is the battery, which has the utmost say in terms of your vehicle's performance and range. To help out, we've prepared a useful guide on selecting the right battery for your needs.

Batteries come in all shapes and sizes, and a variety of different chemistries that all have their own unique properties and applications. When it comes to small electric vehicles, it's desirable to have a battery with a low weight, compact size, plenty of current delivery for quick acceleration, and high capacity for long range.

30 years ago, options were limited to lead acid, nickel cadmium, and nickel metal hydride batteries. These were heavy, with low current output, poor capacity, and incredibly slow charge times. Thankfully, lithium polymer batteries have come along in the meantime and are more capable across the board. Offering huge discharge rates, fast charging, light weight and high capacity, they're undeniably the ultimate choice for a high performance electric vehicle. They're also wildly popular, and thus cheap, too!

There are some hangups, however. It's important to keep all the cells in a pack at the same voltage in order to avoid cells back-charging each other. This can cause damage to the pack, or even explosions or fire. Maintaining the battery voltages to avoid this is called 'balancing'. It can be handled in various ways, depending on the exact style of battery you're using, as we'll cover later.

Additionally, lithium batteries do not like being over-discharged. As a rule of thumb, it's a good idea not to let your batteries drop below 3.0 V per cell. Failure to keep this in check can lead to ruining a pack, hurting its maximum capacity and ability to deliver current.

It's one thing to say you should use a lithium polymer battery, but they come in a wide variety of flavors for different applications. Which type you use will depend on the vehicle you're trying to build, your goals for performance and range, and your own abilities and desire to build or buy.

Due to the limited capacity of the individual cells, many packs for e-bikes and electric vehicles stack several cells in parallel. 18650-based packs are often referred to with designations like 10S4P, indicating there are 4 parallel sets of 10 cells each in the battery. Such a battery would have a nominal voltage of 36 V, with a capacity of between 10-14 Ah depending on the particular 18650 cells used.

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Homebuilt 18650 packs are useful if you want to customise a pack to your own exacting specifications, or if you wish to build on the cheap with recycled parts. However, there's plenty of work involved, and you may find that the money you spend on tools to get the job done outweighs the savings along the way.

For those uninterested in building their own packs, there is another option. With the proliferation of e-bikes around the world, parts are now readily available to those wishing to strike out on their own. A wide variety of battery packs for e-bikes are now available, most of which are built with the exact same tools and techniques as the homebrew packs mentioned above. The major benefit of these ones, however, is that someone else has done all the hard work!

Consisting of 18650 cells laced together in various configurations to suit different applications, they're available in a range of voltages from 36 V-60 V and occasionally higher, with large capacities for long range. The vast majority come with an integrated battery management system and a charge connector already hooked up, and many sellers will throw in a suitable wall charger, too.

The high performance packs also come at a high cost, particularly compared to 18650 cells which have the benefits of economies of scale behind them. They also come without any protection or battery management systems. When used in an electric vehicle, they can either be removed after use and hooked up to a standard RC charger, or wired up to a BMS for a more contained solution for charging. Either way, it's important to pay attention to balancing and maintenance, as these high current packs are more prone to fire and explosions than others.

Lithium polymer cells have also revolutionized the power tool industry, and made cordless tools far more practical than ever before. Most tools on the market use 18 V, or five-cell packs, with different manufacturers using 18650 cells or pouch cells depending on their tastes. They usually come in a hard plastic case with a proprietary connector to hook up to a certain brand of tools. Inside, there's usually a basic BMS to handle cell balance and to shut things down if anything goes wrong.

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