



Pacific Northwest National Laboratory's new Rotating Hammer Riveting Tool enables lightweight magnesium rivets to be used without preheating. The tool also works with aluminum alloy 2024—without the need for storing in a freezer. The invention is faster than conventional riveting in both processes.

ROTATING HAMMER RIVETING TOOL

Enables lightweight magnesium fasteners

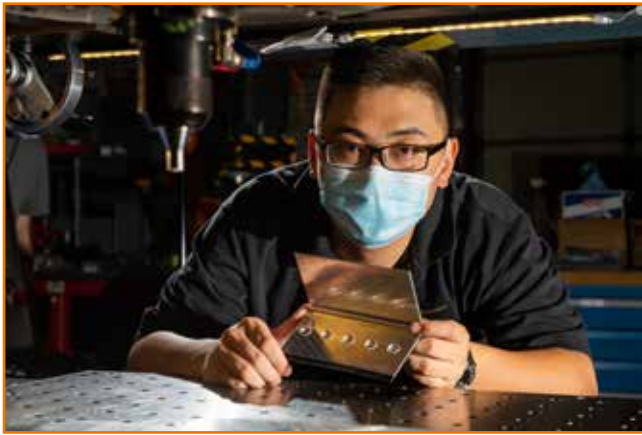
PREHEATING NOT REQUIRED

Magnesium is one of the lightest metals, making it ideal for better fuel economy in vehicles. But it trails behind aluminum and steel in industrial use because it's sometimes brittle and difficult to shape into structural parts. PNNL's friction-based Rotating Hammer Riveting Tool avoids the need to pre-heat the metal to form the rivet and improves the fastening joint. It also works on aluminum rivets, which are used in airplane construction. The processing method also is significantly faster, saving time and money in airplane and vehicle construction.

The technique uses a small rotating tool called a hammer. The rotational force generates heat via friction and deformation, softening the magnesium enough to form the rivet head. Simultaneously, it mixes the underside of the rivet's head to metallurgically bond with the underlying metal sheet. This merging of metals forms a continuous bond that helps to prevent corrosion.

TECHNOLOGY FEATURES

- Can be used to rivet magnesium and aluminum fasteners
- Preheating magnesium not required and improves fastening joint
- Four to 12 times faster than current processing
- Enhances strength and prevents corrosion
- Rivets aluminum alloy 2024 fasteners after they are in the fully hardened state, eliminating the need for cold storage
- Extremely fast process for riveting aluminum fasteners—just 0.25 seconds compared to 1 to 3 seconds per rivet



The Rotating Hammer Riveting Tool is extremely fast. Conventional riveting takes between 1 to 3 seconds per rivet, while PNNL's tool requires just 0.25 seconds.

FASTER, STRONGER PROCESS FOR RIVETING MAGNESIUM FASTENERS

PNNL's patent-pending process deforms the metal, altering its crystalline structure. Using high-powered microscopes, researchers were able to see how the grains were refined and reoriented to make the magnesium more formable and stronger.

WORKS WITH ALUMINUM RIVETS, REDUCES COSTS, AND INCREASES EFFICIENCY

PNNL's Rotating Hammer Riveting Tool works on aluminum rivets, as well, such as those used in aircraft. With hundreds of thousands of rivets on every commercial airplane—mostly made from aluminum alloy 2024—the process could reduce costs and increase efficiency on production lines.



By adopting PNNL's Rotating Hammer Tool, time savings could translate into 40 hours saved per 100,000 rivets—or one full week less spent riveting on just a fraction of one commercial airliner.

Rivets made of aluminum alloy 2024 are too strong to rivet if stored at room temperature. Instead, they must be annealed, or softened, and then stored in a freezer to keep them soft before riveting. Once on the production line, these "ice box rivets" must be used in less than 15 to 30 minutes; otherwise, they become too hard to rivet.

Additionally, PNNL's technology can rivet aluminum 2024 rivets after they are in the fully hardened state, eliminating the need for cold storage. This means rivets would no longer need to be stored in a freezer, riveting is not time sensitive, and unused rivets no longer need to be re-heat treated and re-placed into cold storage.

Processing aluminum using the Rotating Hammer Riveting Tool is extremely fast. Conventional riveting takes between 1 to 3 seconds per rivet, while PNNL's tool requires just 0.25 seconds. That time savings could translate into 40 hours saved per 100,000 rivets. That would mean one full week less spent riveting on just a fraction of one commercial airliner if this technology was adopted.

INDUSTRY APPLICATIONS

The Rotating Hammer Riveting Tool can be used in many advanced manufacturing industries—from automotive and aerospace to energy sectors. The tool could save time and money in the riveting process and is ideal for magnesium and aluminum fasteners.

AVAILABLE FOR LICENSING

PNNL's Rotating Hammer Tool is available for licensing in all fields of use. You can view all the national laboratory's intellectual property at pnnl.gov/available-technologies.

LET'S CONNECT

If you have questions, regarding this technology, please send inquiries to commercialization@pnnl.gov. You can view all PNNL technologies available for licensing at www.pnnl.gov/available-technologies.