THOMSON LAMINATION COMPANY, INC.

Choosing the Right Material

Why is Stack Prototyping Important?

Lamination stacks are essential for suppressing eddy current losses and regulating energy when converting electrical energy to mechanical energy. Motor lamination stacks, also known as lam stacks, are some of the most vital components in electric motors, transformers, generators, vehicles, and other electromechanical systems. Motor lamination stacks consist of thin metal coils stamped into laminations, stacked on top of one another, and assembled together for use. Without lam stacks, eddy currents can generate excessive heat, leading to poor performance or potential motor failure. Using nickel-iron or cobalt-iron materials in motor lamination stacks optimizes costs and wear resistance, making the two materials the most commonly used across critical, high-performance applications.

Lamination stack prototyping is vital before starting mass production to ensure the product's design meets all compliance standards and specifications for the intended application. Stack prototyping can save you time and money by allowing you to test the item before full production runs. For an accurate comparison, prototypes should match the motor lamination stacks as closely as possible, including the material type.

With the numerous material options for lamination stack prototyping, knowing the motor type and performance requirements is key to choosing the best material for your application. Thomson Lamination Company's years of experience in motor stack lamination and high-volume production can help you choose the right material for your stack prototyping needs.

Cobalt Alloys

Cobalt alloys comprise 48-50% cobalt, iron, and a small amount of vanadium. Cobalt is ideal for motor lamination stacks requiring high flux densities, no saturation, and other high-performance applications. Cobalt alloys range in strip thicknesses of .004 to .020 inches. With further processing, an oxide coating can be applied after heat treatment.

Advantages of Cobalt for Motor Lamination Stack Prototyping

There are numerous benefits of using cobalt alloy for lamination stack prototyping because of its high tensile strength and optimal magnetic properties, and can be procured for either property. Cobalt is ideal for weight-sensitive and compact applications and is a long-lasting solution in harsh environments with excellent corrosion, heat, and wear and tear resistance. Cobalt also provides a lower core loss than silicon steel.

Disadvantages of Cobalt for Motor Lamination Stack Prototyping

Cobalt is a pricier alloy compared to others, and its stamping process requires specialized annealing, resulting in longer lead times. Therefore, working with an experienced team is necessary to avoid damaging cobalt's magnetic properties during annealing. Cobalt's magnetic properties can be irreversibly damaged due to improper annealing temperatures.

Nickel Alloys

Motor lamination stacks commonly use nickel because of its low core losses and high permeability at low to moderate inductions. Nickel alloys contain iron combined with 49% nickel or 80% nickel. Nickel alloys range in strip thicknesses of .004 to .020 inches. In some applications, nickel alloys can be supplied with a coating or applied after heat treatment for increased resistivity.

Advantages of Nickel for Motor Lamination Stack Prototyping

Nickel is an affordable option compared to cobalt, offering moderate resistance to moisture and corrosion. Its high permeability and low core losses make it ideal for meeting various motor performance needs.

Disadvantages of Nickel for Motor Lamination Stack Prototyping

The annealing process of nickel requires special considerations and longer processing times. Once annealed, nickel is extremely fragile and requires skilled manufacturers when using the material for motor lamination prototypes. Nickel is more expensive than silicon steel.

Silicon Steel

Also referred to as electrical steel, silicon steel is best for applications where electromagnetic fields are a consideration. Standard silicon steel ranges in thicknesses of 0.014 to 0.025 inches. Thin-gauge silicon steel is also available and ranges in thicknesses of 0.003 to 0.010 inches. Unlike cobalt and nickel alloys, silicon steel comes in a variety of grades and coatings. Silicon steel grades and coatings are chosen based on performance and application requirements. Stack prototyping of generators, reactors, magnetic coils, and transformers commonly uses silicon steel.

Advantages of Silicon Steel for Motor Lamination Stack Prototyping

Silicon steel is a cost-efficient and versatile material that can build and maintain magnetic fields better than regular steel. It is available in multiple grades, coatings, and thicknesses to accommodate many applications. Since it is a widely used material, silicon steel provides shorter lead times. The material allows for greater magnetic penetration, can increase the electrical resistance of components, and reduce core eddy current and hysteresis losses. Silicon steel also causes less wear on stamping tools when compared to other materials.

Disadvantages of Silicon Steel for Motor Lamination Stack Prototyping

Silicon steel has limited performance capabilities when compared to other materials. Long periods of shelf storage are not ideal for silicon steel, and the material rusts in humid environments.

Factors to Consider

When choosing a material for your motor lamination stack prototyping project, there are several factors to consider. Some of the major considerations are the application and performance requirements. This is because each material offers different properties, making each ideal in certain situations over others.

Cobalt Alloys

Cobalt performs well in critical, heavy-duty applications and high-performance applications requiring high flux densities, low saturation, and low weight and size requirements. Industries commonly using cobalt for motor lamination stack prototyping include:

- Aerospace
- Electric Vehicle
- Energy
- Medical
- Military

Nickel Alloys

Nickel alloys perform well in critical, heavy-duty applications. Therefore, it's ideal for stack prototyping in the following industries:

- Medical
- Military
- Aerospace

Silicon Steel

Silicon steel is ideal for any applications with electromagnetic field considerations and electrical applications. Industries incorporating silicon steel for motor lamination stacking include:

- Commercial
- Industrial
- Building and Construction
- Machine Tool
- Energy

Thomson Lamination Company Provides Quality Motor Lamination Stacks

Motor lamination stacks are essential for various electromechanical systems, and stack prototyping ensures your products meet all tolerances and application requirements before mass producing a component. An experienced lamination stack manufacturer can help you choose the optimal materials for your project.

With nearly 60 years of experience in stack lamination prototyping and high-volume production, Thomson Lamination Company produces motor lamination stacks for a variety of industries. We work with numerous materials, including cobalt, nickel, and silicon steel, to effectively limit the eddy current losses and improve the efficiency of any electromechanical system. Our knowledgeable, friendly staff is here to help you make the right project decisions from start to finish.

From custom motor lamination prototyping to meeting precise tolerances to following special annealing considerations, Thomson Lamination Company can accommodate almost any request. Learn more about our specialized stack lamination solutions or request a quote for quality motor lamination stacks for your project.

THOMSON LAMINATION COMPANY, INC.

About Us

Thomson Lamination Company, Inc. (TLC®) was established by John B. Thomson in 1964 to meet the demand for high-end specialty or niche-market stamped electrical parts with extremely tight tolerances, including laminations for use in mission-critical rotating components, annealed at high temperatures in controlled atmospheres. Our plant has expanded from its modest beginnings to now over 76,000 square feet of the most modern production facilities and equipment in the lamination industry.

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Request for Quote

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