

## **APPLICATIONS AND CRITERIA FOR SELECTION OF DIFFERENT TYPES OF FURNACES**

**Huang Junzhang, Masalitina O., Akimov O.**

*National Technical University «Kharkiv Polytechnic Institute», Kharkiv*

As industrial manufacturing evolves, furnace technology continues to innovate, offering more efficient, precise metal treatment solutions for various industries. Common types of furnaces include induction crucible furnaces, electric arc furnaces, converters, vacuum casting furnaces, and low-pressure casting furnaces. Each type, based on its working principle, efficiency, and applicability, demonstrates unique advantages and limitations in different production settings. I will discuss the characteristics, application scenarios, and selection criteria of these five types of furnaces in detail.

We should clarify the selection criteria among these five types of furnaces to ensure optimal production efficiency and product quality. Here are detailed supplements to the selection criteria for induction crucible furnaces, electric arc furnaces, converters, vacuum casting furnaces, and low-pressure casting furnaces:

**Material and Performance Requirements.** Vacuum casting furnaces are best for materials requiring ultra-high purity and specific properties, such as high-temperature aerospace alloys and medical titanium alloys.

Low-pressure casting furnaces are more suitable for non-ferrous metal castings needing high precision and excellent surface quality, particularly in automotive and aerospace industries.

For precious metals or high-quality production of non-ferrous metals on a small scale, induction crucible furnaces are preferred due to their high energy efficiency and clean melting process.

For the mass production of steel materials, especially using scrap, electric arc furnaces and converters are better choices. Electric arc furnaces are suitable for flexible production needs and special steels, while converters are better for large-scale, cost-efficient production.

**Production Scale and Cost Control.** Converters are ideal for large-scale production of low-cost steel due to their high production efficiency and low material costs. Electric arc furnaces offer flexibility beneficial for medium to large enterprises needing to adjust production scales and product types. Despite their high investment and operational costs, vacuum casting furnaces and low-pressure casting furnaces provide superior product quality for small batches of high-value products, offering significant benefits for industries like aerospace and precision equipment manufacturing.

**Energy and Environmental Considerations.** Vacuum casting furnaces and low-pressure casting furnaces are environmentally friendly and suitable for regions and markets with strict environmental regulations.

In areas with abundant and cost-effective electricity, electric arc furnaces are an economical choice, although they may produce significant noise and dust during operation.