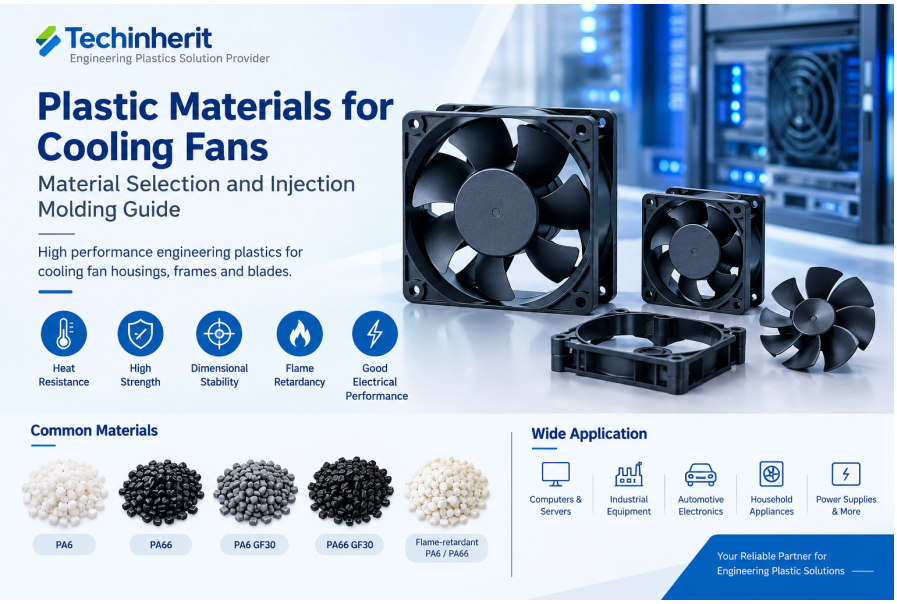
Plastic Materials for Cooling Fans

Material Selection and Injection Molding Guide

Cooling fans are widely used in computers, servers, industrial equipment, household appliances, automotive electronics, power supplies, and other thermal management applications. Although the motor and electronic components are important, the plastic housing, fan frame, blades, and other injection-molded components also have a significant influence on the performance, reliability, and service life of the cooling fan.

Choosing the right engineering plastic is therefore critical. The material needs to provide sufficient mechanical strength while maintaining dimensional stability, heat resistance, electrical performance, and good injection molding characteristics.

At Techinherit, we provide customized engineering plastic material solutions for cooling fan plastic components, including PA6, PA66, glass-fiber-reinforced nylon, flame-retardant nylon, and other modified engineering plastics.



Techinherit engineering plastic solutions for cooling fan housings, frames and blades.

1. What Plastic Materials Are Commonly Used for Cooling Fans?

Different cooling fan applications require different material properties. Common materials include:

- • PA6
- • PA66
- • PA6 GF30
- • PA66 GF30
- • Flame-retardant PA6 and PA66
- • Other customized modified engineering plastics

The best material depends on the operating temperature, mechanical load, flame-retardant requirements, electrical requirements, dimensional tolerances, and final application.

PA6

PA6 offers good toughness, impact resistance, wear resistance, and processing performance. It can be considered for cooling fan components where balanced mechanical performance and cost are important.

PA66

PA66 generally provides better heat resistance and mechanical performance than standard PA6. It is particularly suitable for cooling fan components operating in relatively high-temperature environments.

Glass-Fiber-Reinforced Nylon

Adding glass fiber can significantly improve stiffness, strength, heat resistance, and dimensional stability.

For example, PA6 GF30 and PA66 GF30 are commonly considered when the cooling fan housing or frame requires higher rigidity and reduced deformation.

However, glass-fiber reinforcement also changes the flow behavior and shrinkage characteristics of the material. Therefore, mold design and injection molding parameters need to be optimized accordingly.

2. Key Requirements for Cooling Fan Plastic Parts

A cooling fan plastic component may appear simple, but its working environment can be demanding.

2.1 Heat Resistance

Cooling fans are frequently installed near heat-generating electronic components. Continuous exposure to elevated temperatures can cause ordinary plastics to soften, deform, or lose mechanical strength.

For high-temperature applications, PA66 or reinforced PA66 can be evaluated depending on the actual operating conditions.

The material should be selected according to the actual continuous-use temperature rather than simply the material's short-term heat resistance.

2.2 Dimensional Stability

Dimensional accuracy is particularly important for fan frames and housings.

If the plastic housing warps during injection molding, problems may occur during assembly. Excessive deformation can also affect the alignment between the fan blade, motor, bearing, and housing.

Glass-fiber-reinforced nylon can provide improved dimensional stability, but its anisotropic shrinkage must be considered during mold and process design.

2.3 Mechanical Strength

The fan housing must maintain its structural integrity during assembly, transportation, and long-term operation. Depending on the application, the plastic part may need to withstand:

- • Assembly forces
- • Screw fastening
- • Vibration
- • Impact
- • Continuous rotation-induced vibration
- • Thermal cycling

For applications requiring higher rigidity, reinforced nylon materials are often a suitable starting point for material selection.

2.4 Flame Retardancy

For cooling fans used in electrical and electronic equipment, flame-retardant requirements may apply. A flame-retardant PA6 or PA66 grade can be selected when the final product requires a specific flammability rating.

However, flame-retardant systems can affect processing behavior, surface appearance, mechanical properties, and mold cleanliness. Material selection should therefore consider the complete performance requirements rather than focusing only on the flame-retardant rating.

3. Common Injection Molding Problems in Cooling Fan Components

Even when the correct plastic material is selected, improper injection molding conditions can cause quality problems.

Warpage and Deformation

Warpage is one of the most common problems in reinforced nylon injection molding. Possible causes include:

- • Uneven wall thickness
- • Uneven cooling
- • Incorrect gate location
- • Excessive injection or packing pressure
- • Different fiber orientations
- • Improper mold temperature
- • Uneven shrinkage

A combination of material optimization, mold design, and process adjustment is normally required to reduce deformation.

Short Shot

A short shot occurs when molten plastic does not completely fill the mold cavity. Potential causes include:

- • Insufficient injection pressure

- • Low melt temperature
- • Low injection speed
- • Poor gate or runner design
- • Insufficient venting
- • Excessively thin sections

Increasing injection speed or melt temperature may help, but these parameters should be adjusted together with the mold design and material characteristics.

Floating Fiber on the Surface

Glass-fiber-reinforced nylon may develop visible fiber marks or a floating-fiber appearance on the surface. This can become particularly noticeable on black or high-gloss fan housings.

Possible solutions include optimizing:

- • Melt temperature
- • Mold temperature
- • Injection speed
- • Gate design
- • Material formulation
- • Fiber content
- • Packing conditions

The target should be determined according to the required appearance of the final product.

4. How to Improve Cooling Fan Plastic Part Quality

A successful cooling fan project requires cooperation between material selection, mold design, and injection molding.

Step 1: Define the Application Requirements

- • Operating temperature
- • Required mechanical strength
- • Flame-retardant requirements
- • Electrical requirements
- • Surface appearance
- • Dimensional tolerance
- • Expected service life
- • Production volume

This information helps narrow down the appropriate material grade.

Step 2: Select the Base Resin

PA6, PA66, or another engineering plastic can be selected according to the application's performance requirements. For higher-temperature applications, PA66 may be considered. For higher rigidity and dimensional stability, glass-fiber-reinforced nylon can be evaluated.

Step 3: Optimize the Material Formulation

- • Higher stiffness

- • Improved impact resistance
- • Better heat resistance
- • Flame retardancy
- • Improved dimensional stability
- • Better surface appearance
- • Customized color

Material modification can be used to achieve specific requirements. A customized formulation can be particularly useful when standard commercial grades cannot meet the customer's requirements.

Step 4: Optimize Mold Design

- • Gate position
- • Runner dimensions
- • Venting
- • Cooling channels
- • Wall thickness
- • Ejection system
- • Fiber orientation

Material performance alone cannot solve every injection molding problem. Proper mold design can significantly improve filling, cooling, dimensional stability, and surface quality.

Step 5: Optimize Injection Parameters

- • Barrel temperature
- • Mold temperature
- • Injection speed
- • Injection pressure
- • Holding pressure
- • Holding time
- • Cooling time
- • Screw speed
- • Back pressure

Injection parameters should be adjusted based on the selected material and mold structure. For glass-fiber-reinforced nylon, controlling processing conditions is especially important because fiber orientation can influence shrinkage and warpage.

5. Why Material Selection Should Be Considered Together With Mold and Injection Molding

One common mistake is to treat plastic material selection as an independent step. In reality:

Material + Mold Design + Injection Process = Final Part Performance

For example, a material with excellent mechanical properties may still produce poor cooling fan components if the mold has inadequate venting or an unsuitable gate position.

Similarly, changing from standard PA6 to PA6 GF30 does not automatically eliminate deformation. The higher fiber content may introduce different shrinkage behavior and require corresponding process adjustments.

Therefore, material suppliers with technical support capabilities can help customers identify the actual cause of a plastic part problem instead of simply changing the material grade.

6. Techinherit Cooling Fan Plastic Material Solutions

Techinherit focuses on engineering plastic solutions for injection-molded components. Our capabilities include customized materials for:

- • DC cooling fans
- • Axial cooling fans
- • Electronic cooling fan housings
- • Fan frames
- • Fan blades
- • Electrical equipment cooling components
- • Household appliance components
- • Automotive electronic components

Depending on the application, we can evaluate materials such as PA6, PA66, glass-fiber-reinforced nylon, flame-retardant nylon, and other modified engineering plastics.

Our technical approach focuses on the complete injection molding process, including material selection, mold compatibility, injection conditions, dimensional stability, surface appearance, and final application requirements.

7. Conclusion

The plastic material used in a cooling fan is more than just a structural component. It directly affects the fan's dimensional accuracy, mechanical strength, heat resistance, surface appearance, and long-term reliability.

For general applications, PA6 and PA66 can provide a balanced combination of performance and processing characteristics. When higher rigidity, strength, or dimensional stability is required, glass-fiber-reinforced nylon can be considered. For electrical and electronic applications with specific fire-safety requirements, flame-retardant engineering plastics may be necessary.

The most effective solution is not simply selecting a stronger material. Instead, the material, mold design, and injection molding process should be evaluated as one integrated system.

Techinherit provides customized engineering plastic solutions for cooling fan components and other injection-molded plastic applications. Contact us with your product drawings, current material, or injection molding problems, and our technical team can help evaluate a suitable material solution.