



Sintergy Short: Do's and Don'ts for Molding Shapes in Powder Metal

Powder metallurgy (PM) is a cost-effective and highly efficient process for producing complex metal parts with minimal material waste. However, achieving optimal results depends heavily on designing parts with manufacturability in mind. Unlike machining or casting, PM has unique considerations related to compaction, sintering, and tooling constraints. Understanding these factors can help engineers design parts that maximize strength, consistency, and cost-effectiveness while avoiding common pitfalls.

One of the most important **do's** in PM design is to keep shapes simple and symmetrical whenever possible. Uniformity helps ensure even compaction, leading to consistent density and mechanical properties throughout the part. Additionally, incorporating slight draft angles (typically 2-5 degrees) facilitates smooth ejection from the die, reducing stress on tooling and preventing cracks or surface defects. Engineers should also pay close attention to parting lines—these should be positioned strategically to allow for proper tool separation and avoid unnecessary machining. Furthermore, gradual transitions between features and maintaining consistent wall thickness improve material flow during compaction, preventing weak points in the final part.

On the other hand, certain design choices should be avoided to prevent manufacturing challenges. **Undercuts and complex internal features** are difficult to achieve in standard PM processing because the compacted powder cannot be removed from the die without additional machining, increasing cost and lead time. Similarly, large variations in wall thickness should be minimized, as they can cause uneven density distribution, leading to distortion or failure during sintering. Designers should also resist the temptation to over-design parts that require extensive secondary machining—PM is a near-net shape process, and excessive post-processing eliminates its cost and efficiency advantages, however, is sometimes necessary.

By following these **do's and don'ts**, we can take full advantage of powder metallurgy's strengths, ensuring high-quality, durable parts that are optimized for production. Thoughtful design not only improves mechanical performance but also enhances cost savings by reducing material waste and minimizing secondary operations. Stay tuned for the next **Sintergy Short**, where we'll explore another key aspect of PM technology and its benefits for various industries!