

Crafting Excellence: The Modern Investment Casting of an African Spear Point

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The crafting of an African spear point has a rich history deeply intertwined with cultural significance and practical functionality. Over the years, the techniques and materials employed in creating these spear points have evolved, blending tradition with modern innovation. In this article, we delve into the intricacies of manufacturing an African spear point using the investment casting process, showcasing the fusion of heritage and modern technology.

Cultural Significance and Design

The African spear, such as the Iklwa spear of the Zulu tribe, holds a vital place in African history. It was used for hunting, warfare, and ceremonial purposes, reflecting the diverse aspects of African society. The spear's design, including its blade shape and attachment mechanisms, was based on traditional African spear point structures. Pittsburg State University's participation in the 2023 SFSA Cast In Steel competition provided an opportunity to honor these traditions while employing modern methodologies.

Material Selection

For this endeavor, the spear point material was a crucial consideration. After meticulous research and consultation with experts, the team chose a modified 4140 steel alloy. This steel is renowned for its toughness, wear resistance, and ability to maintain a sharp edge. The decision was based on a careful balance between durability and performance, ensuring the spear point could withstand impact forces while remaining functional.

Gating and Casting Design

To optimize the casting process, careful attention was given to gating



and treeing. Simulation software such as MAGMASOFT was employed to visualize the flow of molten steel and solidification. Different gating and feeding methods were explored, leading to the choice of gating designs that minimized casting defects and ensured consistent fill. The final gating design incorporated elements to reduce the possibilities of shrinkage and ensure proper flow.

Investment Casting Process

The chosen manufacturing process was investment casting, known for its ability to produce complex shapes with high precision. The process began with the team creating a die for wax injection of the spear point patterns, followed by tree assembly, and coating it in ceramic shell. Once the wax was melted out, molten steel was poured into the mold at Monett Metals in Monett, MO. After solidification the spear point went through casting cleaning, heat treating and complete finishing. Investment casting enabled the replication of





intricate designs and the creation of a high-quality, accurate and artistic spear point.

Metallurgical Analysis and Testing

Material testing was a critical step to ensure the desired hardness and mechanical properties were achieved. Both as-cast and post-heat treatment samples were examined to validate the hardness values of the modified 4140 steel alloy. Testing confirmed the successful heat treatment process and verified the alloy's capability to meet the requirements for hardness and strength.

Performance Testing

The ultimate proof of the spear point's effectiveness lay in its performance. Rigorous testing was conducted to simulate real-world scenarios. Stabbing and slicing tests were performed using materials such as wood boards, sandbags, and aluminum blocks. These tests demonstrated the spear point's ability to penetrate tough materials and retain its sharp edge. The results affirmed that the chosen steel alloy and investment casting process produced a spear point that was both durable and functional.

Conclusion

The creation of an African spear point using modern methods and materials is a testament to the convergence of



tradition and innovation. Pittsburg State University's participation in the 2023 SFSA Cast In Steel competition showcased the dedication to preserving cultural heritage while embracing modern technology. The investment casting process, combined with metallurgical analysis and rigorous testing, resulted in a high-quality spear point that honors Africa's rich history and demonstrates the prowess of modern manufacturing techniques. This

endeavor not only produces a functional tool but also embodies the spirit of craftsmanship and cultural pride.

Pittsburg State University Team

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