



Learning the Trade of Blacksmithing

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ABSTRACT

This project delved into the multifaceted world of blacksmithing, merging scientific inquiry with traditional craftsmanship to understand the nuances of metal work and material sciences. The primary objective was to immerse in the practicality of the craft, with the intent of learning the use of essential tools, the operational aspects of a forge, and further developing my knowledge of material properties of metals. In the aspect of material properties, a target was made to cultivate a comprehensive understanding of the manipulation of metal properties, utilizing heat treatment, cooling, and knowledge of metallurgical behavior.

OBJECTIVES

- **To immerse in the practicality of blacksmithing:** Learn the use of essential blacksmithing tools and the operational aspects of a forge.
- **To develop a comprehensive understanding of material properties of metals:** This includes understanding how different treatments like heating, cooling, and specific metallurgical behaviors manipulate metal properties.
- **To acquire hands-on competencies in manipulating metal:** Through heating, working, and cooling processes, craft rudimentary objects such as hooks and nails, with a progression towards more intricate creations like knives and ornamental ironworks.
- **To combine theoretical study with empirical experience:** Utilize a twofold methodology that includes studying literature and visual resources for foundational knowledge and engaging in empirical learning through active participation in local blacksmithing workshops.
- **To explore the potential for post-graduate entrepreneurial ventures:** Use the skills and knowledge acquired to consider starting a business specializing in custom-made tools and decorative arts, thereby linking the craft of blacksmithing with contemporary business opportunities.

METHODOLOGY / METALLURGY

Beginning with a foundational understanding of the material properties and phase transformations of carbon steel, the project involved systematic heat treatment processes to manipulate these properties.

Heat Treatment Cycles:

- **Forging:** Heated steel to above the critical temperature and forged with hammers and anvil to create desired object.
- **Normalizing:** Relieved internal stresses and refined grain structure through controlled heating and air cooling.
- **Austenitizing:** Heated steel to above the critical temperature to form austenite.
- **Quenching:** Rapidly cooled the steel in water, oil, or air to form hard martensite.
- **Tempering:** Reheated the quenched steel to a lower temperature to reduce brittleness while maintaining hardness.

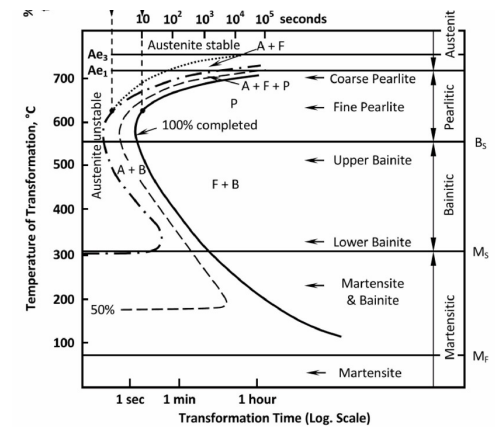
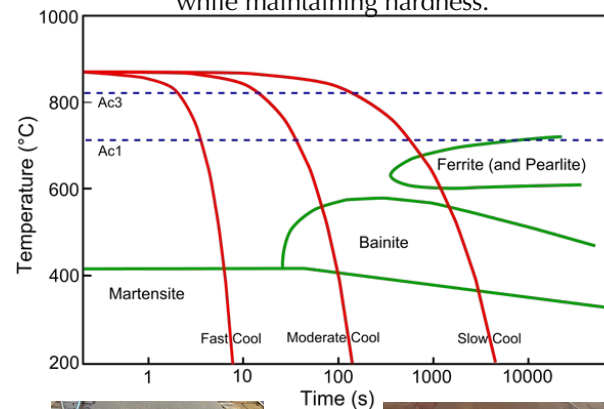


Figure 1 – Typical TTT diagram for carbon steel depicting time required for beginning, 50% and 100% transformation of austenite at a constant temperature (A= Austenite, F= Ferrite, P= Pearlite and B = Bainite)

