

THE SAMURAI SWORD DESIGN

The universally revered Samurai Sword embodies steel's remarkable and valued properties emanating from steelmaking and metal working expertise. The correct fusion of these skills results in the legendary sword recently featured in the NOVA special "*Secrets of the Samurai Sword*"¹. This video production highlights the technical and geo-social aspects of this renowned sword. The following is a brief outline for this design project.

- I. Ore Reduction (production of the *tatara*)
 - A. Furnace design
 - B. Furnace materials selection
 - C. Heat transfer, thermodynamics, kinetics
 - D. Safety requirements
- II. Furnace Construction and Instrumentation
- III. Raw Materials Procurement and Evaluation (attempt in the proof of concept to use same (or similar) iron ore and carbon materials as Japanese swordsmiths)
 - A. Chemical analysis of starting materials (XRD etc.)
 - B. Mineral beneficiation (if necessary)
- IV. Steelmaking (production of low-carbon and high-carbon *tamahagane*)
 - A. Process monitoring and control
 - B. Chemical analysis
 - C. Safety protocols and plans
- V. Consolidation, Identification and Removal of Impurities (*tamahagane*)
 - A. Forging
 - B. Chemical analysis
- VI. Swordsmithing (making the *katana*)
 - A. Safety plan and procedures
 - B. Formation of the inner *katana*
 - C. Formation of the outer *katana*
 - D. Forging and heat treatment of the complete *katana*
 - E. *katana* heat treatment and surface modification
 - F. Surface polishing
 - G. Surface preservation
 - H. Measurement of sword performance (both traditional Samurai and metallurgical (hardness, strength etc.)

*<http://www.pbs.org/wgbh/nova/samurai>