

Crucible Steel Production:
An Experimental Study of Crucible Composition and Structure.

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The production of crucible steel has been successfully replicated by several leading metallurgists in the past 20 years, but replicating crucible steel production using ancient crucibles and traditional fuel has been more problematic. This paper will discuss the results of smelting experiments performed under various conditions to produce crucible steel. A variety of crucible fabrics were examined, from commercial clay graphite crucibles to traditional crucibles made from different types of clay and refractory materials such as rice husks, granite and quartz sand. Smelting was carried out using both coke fuel with continuous airflow and hardwood charcoal fuel with pulsing blasts of air. Several iron materials were smelted including magnetite sand from the Hunza River, Pakistan, Tamhangane steel from Japan, and Michigan hematite ore. Some of the post-smelt products were chemically analyzed, and the post-firing crucibles were thin-sectioned for petrographic analysis. The impetus behind this work lies in the fact that few researchers have studied the effects that raw material selection, crucible composition, and fuel choice have on wootz steel production and the effects on the final product. With a better understanding of the stages of steel production, archaeologists will be better able to understand the localized Indian smelting traditions that created chemically unique wootz steels and that allowed certain Indian communities to engage on a larger scale with the trade networks that connected India, the Red Sea, and the Roman Empire.