A Tale of Wootz Steel

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The extraordinary romance and thrilling adventure associated with the tale of wootz steel shows how Indian metallurgists were the world leaders in antiquity in the manufacture of this legendary high-grade steel. In many ways this material was brought to global attention by the writings of Cyril Stanley Smith. Modern metallurgy and materials science rest on the foundation built by the study of this steel during the past three centuries.

1. Introduction

Wootz steel was highly prized across several regions of the world over nearly two millennia and the products made of this Indian steel came to be known as Damascus swords. Figure 1 shows a splendid example of the sword of Tipu Sultan. It is no exaggeration to state that wootz steel as an advanced material dominated several landscapes: the geographic landscape spanning the continents of Asia, Europe and the Americas; the historic landscape stretching over two millennia as maps of nations were redrawn and kingdoms rose and fell; the literary landscape as celebrated in myths and legends, poetry and drama, movies and plays; the linguistic landscape of Sanskrit, Arabic, Urdu, Japanese, Tamil, Telugu and Kannada. It held sway over the religious landscape through trade and other interactions of Hinduism, Buddhism, Zoroastrianism, Judaism, Islam and Christianity. This is unique as no other advanced material can display this multifaceted splendour.

The development of wootz steel by sheer empirical practice in Southern India, the fashioning of the steel by thermo-mechanical treatments to fierce and beautiful Damascus Swords in India and the Middle East with little knowledge of the underpinning science is a remarkable tale in the annals of metallurgy. When
this steel was presented to the Western world, scientists in England, France, Russia and Sweden toiled hard and discovered the composition and microstructure and their relation to mechanical properties. This single-minded pursuit of an Eastern technological product by Western scientists for over a century created the foundations of modern materials science. Cyril Stanley Smith has emphasized this theme in his writings. In addition there is a possible connection with nanomaterials and computer modeling. Thus the investigations on wootz steel continue to inspire researchers to this day.

2. Iron and Steel Heritage of India

India has been reputed for its iron and steel since ancient times. The Delhi Iron Pillar is a marvellous monument. There are numerous early literary references to steel from India from Mediterranean sources including one from the time of Alexander (3rd c. BC), who was said to have been presented with 100 talents of Indian steel. Arabs took ingots of wootz steel to Damascus following which a thriving industry developed there for making weapons and armour of this steel, the renown of which has given the steel its name. In the 12th century the Arab Edrisi mentioned that the Hindus excelled in the manufacture of iron and that it was impossible to find anything to surpass the edge from Indian steel. The famous novel “The Talisman” by Sir Walter Scott narrates the encounter between King Richard of England, known as Lion Heart and Sultan Saladin during the third crusade. Though this 1825 account is fictional, it is evident that the fame of the swords made out of wootz steel spread to Europe, when the crusaders encountered them at Damascus. One possible origin for the term Damascus swords is traced to this encounter. In 1912, Robert Hadfield who studied crucible steel from Sri Lanka recorded that Indian wootz steel was far superior to that previously produced in Europe.

It is ironic that not too many records are available documenting the process of wootz production. It is mainly the European travelers who left detailed accounts. These include Francis