



**Investment Casting: A Treasure Trove.** A. M. Sriramamurthy. DESIDOC, Metcalfe House, Delhi 110 054. 2015. xviii + 338 pages. Rs 1300. DRDO Monographs/Special Publications Series. ISBN 978-81-86514-83-2.

This monograph is published by DESIDOC and is a valuable addition to the growing literature of the History of Modern Indian Technology. India is often perceived as a citadel of spirituality. Its contributions to science and technology are not as widely known as they ought to be. It was a world leader in steel and sword making and textiles in ancient times. During the colonial period both industries were destroyed.

Since independence in 1947, remarkable advances in technology in the strategic sectors of Defence, Atomic Energy and Space have taken place. This is an appropriate time to recount the success stories. Also the difficulties in the journey, as technology denial regimes operated, need to be documented, as India seeks to regain its place.

It is a particular pleasure to review this interesting book. The reviewer had the privilege of the ringside view, as he knew many of the protagonists.

The jet engine is perhaps one of the most disruptive developments, as it helped us to conquer distance. The inventor of this engine was Frank Whittle. He was a Fellow of Peterhouse, Cambridge University, which is also the Alma Mater of the reviewer.

In India, the development of jet engines was mandated to GTRE along with the development of materials and requisite technology by DMRL under the visionary leadership of V. S. Arunachalam. His decision to follow the investment casting route for turbine blades and vanes was an audacious and momentous one.

He was also attached to this technique as it was the same one used by our ancestors in the civilization in Harappa and Chola empires. As a leader he inspired a

number of his colleagues in taking up challenging technologies. A. M. Sriramamurthy was fascinated with investment casting technology, when he joined DMRL and stayed with a fierce passion and single minded devotion to master this complicated technology till his retirement. GTRE was of great help in evaluating the products in the Kaveri engine. Hindustan Aeronautics Limited played a crucial role in production.

The book is divided into eight chapters. The first chapter is an introduction and delineates the development of the turbojet engines. The second chapter gives a narrative of superalloys. The star among them is the one based on intermetallic nickel aluminide. This is indeed a fascinating material consisting of 13 elements or more with 27 elements in close control. The entire periodic table comes into play. Robert Cahn, mentor of Arunachalam, stated that the design of superalloys gave the right to metallurgists to claim their rightful place in the engineering brotherhood.

The third chapter details the development of investment casting. Subsequent fourth to sixth chapters deal in great detail with the die design, ceramic cores and surface protection coatings, all of which will be useful for the practitioners. When one realizes that ingenious technology allows them to function above their melting points, we can marvel at the innovations of this development.

The seventh chapter on indigenization of equipment narrates the trials and tribulations of the author. The eighth chapter on overview of achievements is a realistic account.

Three appendices provide useful information.

The book has been authored by a technologist who lived, dreamt, and breathed turbine blades for over four decades. This is an exceptional achievement.

The author has listed the names of many who were with him on this journey. It would have been better, if their contributions had been briefly spelt out. The reviewer is aware of the contributions of Rama Rao, Dipankar Banerjee, Niranjana Das, Rangachari Krishnan and Krishnadas Nair. A timeline giving years, institutions and individuals would have been of great help.

Technology has built in obsolescence. From Dheepa Srinivasan (GE) and Dipankar Banerjee (IISc), news comes that the route that is gaining ground is additive manufacturing and 3D printing.

Printing first for repair and then in the future perhaps in actual manufacture that will enable a quick turn around of low volumes of castings without the cost and time implications of dies and ceramic core manufacture.

Cyril Stanley Smith stated that our discovery and pursuit of materials was driven by aesthetics and not utilitarian considerations. The jet engine is among the most useful of this utilitarian part. The aerofoil is one of the most beautiful shapes that Bernoulli equations yield us. Thus, form and function combine in exquisite harmony.

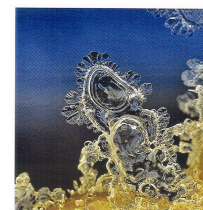
DESIDOC has already brought out six monographs. This is now a well established process which will archive the science, engineering and technology heritage of India.

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**Snow, Ice and other Wonders of Water: A Tribute to the Hydrogen Bond.** Ivar Olovsson. World Scientific Publishing Co Pte Ltd, 5 Toh Tuck Link, Singapore 596224. 2016. viii + 116 pp. Price: US\$ 19.

The book under review is a simple book that talks about one of the most intriguing substance in the world – water. The first 50 pages of the book are on the wonderful properties of water. Chapters 1–5 discuss the artificial snow crystals, snow and ice crystals in nature, how snow is used



Ice crystal

for pleasure and as an art. Chapters 6–8 are more technical and deal with ice surface, a structural/chemical and physical properties of water. However, they are written in a lucid manner and can be understood by a lay person. Some portions of the book (pp. 50–113) are basically reproduced from three research papers that would interest a scientist but not a lay person. The photographs are outstanding.

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