

INVESTMENT CASTING – LOST WAX CASTING – THE PROCESS AND HISTORY

Casting metal into a mold produced by surrounding, or investing, an expendable pattern with a refractory slurry coating that sets at room temperature, after which the wax or plastic pattern is removed through the use of heat prior to filling the mold with liquid metal. Also called precision casting or lost wax process . (2) A part made by the investment casting process.

Investment casting is a versatile process, used to manufacture parts ranging from turbocharger wheels to golf club heads, from electronic boxes to hip replacement implants. The industry, though heavily dependent on aerospace and defence outlets, has expanded to meet a widening range of applications. Modern investment casting has its roots in the demands of the Second World War, but it was the adoption of jet propulsion for military and then for civilian aircraft that stimulated the transformation of the ancient craft of lost wax casting into one of the foremost techniques of modern industry.

Investment casting expanded greatly worldwide during the 1980s, in particular to meet growing demands for aircraft engine and airframe parts. Today, investment casting is a leading part of the foundry industry, with investment castings now accounting for 15% by value of all cast metal production in the UK.

HISTORY

Investment casting dates back thousands of years. Its earliest use was for idols, ornaments and jewellery, using natural beeswax for patterns, clay for the moulds and manually operated bellows for stoking furnaces. Examples have been found in India's Harappan Civilisation (2000 BC - 2500 BC) idols, Egypt's tombs of Tutankhamun (1333 – 1324 BC), in Mesopotamia, Mexico, and the Benin civilization in Africa where the process produced detailed artwork of copper, bronze and gold.

The earliest known text that describes the investment casting process (Schedula Diversarum Artium) was written around 1100 A.D. by Theophilus Presbyter, a monk who described various manufacturing processes, including the recipe for parchment. This book was used by sculptor and goldsmith Benvenuto Cellini (1500 - 1571), who detailed in his autobiography the investment casting process he used for the Perseus and the Head of Medusa sculpture that stands in the Loggia dei Lanzi in Florence, Italy.

Investment casting came into use as a modern industrial process in the late 19th century, when dentists began using it to make crowns and inlays, as described by Dr. D. Philbrook of Council Bluffs, Iowa in 1897. Its use was accelerated by Dr. William H. Taggart of Chicago, whose 1907 paper described his development of a technique. He also formulated a wax pattern compound of excellent properties, developed an investment material, and invented an air-pressure casting machine.

In the 1940s, World War II increased the demand for precision net shape manufacturing and specialized alloys that could not be shaped by traditional methods, or that required too

much machining. Industry turned to investment casting. After the war, its use spread to many commercial and industrial applications that used complex metal parts. For example, Sturm, Ruger, founded in 1949, based much of its manufacturing on the then newly-adopted technology, rising to dominance in the firearms manufacturing world through the elimination of labor-intensive machining of firearms as had been common practice in the firearms industry.

Modern investment casting techniques stem from the development in the United Kingdom of a shell process using wax patterns known as the Investment X Process. This method resolved the problem of wax removal by enveloping a completed and dried shell in a vapor degreaser. The vapor permeated the shell to dissolve and melt the wax. This process has been evolved over years into the current process of melting out the virgin wax in an autoclave.

More information:

http://en.wikipedia.org/wiki/Investment_Casting
http://www.microfond.it/lost_wax_casting_process.htm