

Ferrous Metals Evaluation In Terms Of 'Wrought Ironwork'

Technical information No: 2

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WROUGHT IRON

Wrought iron is the old material of the blacksmith and resists corrosion far better than modern steel as is amply shown by the survival of much of our heritage of wrought ironwork, in many cases, centuries old.

There are essentially two types of wrought iron;

‘PUDDLED IRON’

The close of the eighteenth century brought mass -produced puddled irons. Made in a coal-fired furnace, remote from the fire itself, puddled iron is the typical engineering material of the nineteenth century, works well hot and resists corrosion. It has, however restrictions for cold working, particularly in sheet form.

Wrought iron owes its rust proof properties to its fibrous nature. In modern terms, the refining of wrought iron is a crude process, and results in the inclusion of non-corrodible slags in the structure of the metal. These slags, and the softness of the material when hot, led to an ease of working by hand, which gave rise to a great art form ‘Wrought Ironwork’.

The Real Wrought Iron Company are able to offer genuine puddled wrought iron rolled into all sizes of square, round and flat bars from stock or to your requirements. They specialise in the production of iron for the purposes of restoration and can match any existing section. They also make charcoal iron in sheet form for cold repoussé work and armour etc. and manufacture special mouldings in puddled iron.

‘CHARCOAL IRON’

Before the dawn of the industrial age, the metal of the blacksmith was wrought iron, made and refined in charcoal fires. The iron combined with the elements of the fire to make an individual material whose properties have never been equalled for ornamental ironwork. The great wrought ironwork of the eighteenth century was done in such metal, and very many examples exist today. For example the Screens at Hampton Court by Jean Tijou, the work of Thomas Bakewell and the Davies Brothers' gates at Chirk Castle, to name a few.

Charcoal iron can withstand corrosion for hundreds of years as proven by the fact that there is a wealth of heritage ironwork in existence. Traditional ironwork is not easy to maintain, as elements of design are frequently difficult or even impossible to paint. This applies particularly to leaf work and repoussé sheet metalwork, especially where elements are back-to-back or three-dimensional. The only material to use for replacements during conservation is one that is intrinsically proof against corrosion.

Charcoal iron sheet is soft and malleable when annealed, so that a good depth of cold working and sharp detail is possible without cracking. It is softer and more

pleasant to work than mild steel, and responds well to both lead block and pitch block repoussé techniques.

Charcoal iron sheet has a smooth surface, largely free of scale, and responds well to planishing and abrasive polishing making it ideal for the accurate replication of armour and weaponry.

The Real Wrought Iron Company recycles old charcoal iron and has pleasure in making it available once again. Sheet is available in standard rolled thicknesses or in billet form for your own reduction.

MILD STEEL

An alloy of iron and carbon which was discovered in 1856 in an attempt to mass-produce wrought iron and became cheaper than puddled iron after 1876. Mild steel is made by melting scrap steel and cast iron with the removal of carbon (leaving a small residual content) and slag before casting into ingots ready to be rolled into sections. It has higher strength and better consistency than wrought iron but has poor resistance to corrosion as is evident by an insistence on zinc coating for work to be used externally.

PURE IRON

Chemically pure iron is made for use in the electrical industries for its low hysteresis. It also finds a use in the chemical and shipbuilding industries for sacrificial anodes as it corrodes preferentially to mild steel and hence protects it. Pure iron is claimed by its suppliers to have properties of resistance to corrosion, but its manufacturers make no such claim, and indeed manufacture other steels with corrosion resistance in mind, such as Corten, or Weathering Steel. Pure iron can be forged and forge-welded, as can mild steel but is rather more expensive.

WEATHERING STEELS

Manufactured for use in aggressive environments, or for external use without painting, weathering steels (Corten) are made in structural sections, typically for bridge girders etc. They have lately become less fashionable as they have been found to suffer badly from crevice corrosion. This is not a material used by blacksmiths.

STAINLESS STEELS

Widely available in various grades, and used extensively in a modern context, stainless steels are not as forgeable as other ferrous metals, being very hard and cannot practically be forge welded. There is a growing awareness of the limitations of stainless steels as their resistance to crevice corrosion is not always good, to the extent that mild steel is preferred in some circumstances. For this reason stainless steel should not be used as a substitute for wrought iron in lead sockets in stonework etc.

CAST IRON

The other classic metal of the nineteenth century, cast iron is famous for its ability to resist weathering, and in normal situations in the external environment cannot be faulted. The traditional form of cast iron, known as 'grey iron' is however notable for its brittleness and has to be used with care. Grey irons have very low tensile strength. There is a modern variant of cast iron known as 'S G Iron', which has very good tensional properties, is not brittle and can in fact be bent cold to some extent. It cannot be forged and, being relatively modern, its weathering properties are as yet unknown.

MATERIALS FOR THE REFURBISHMENT OF HERITAGE IRONWORK

Mild steel is used as the modern replacement for wrought iron and many metalworkers are perfectly content to use this much cheaper metal both for new work and the refurbishment of old. I would like to suggest the reasons why this is not acceptable in the context of historic work, especially while wrought iron is still available.

1. WEATHERING PROPERTIES; the weathering properties of wrought iron are well known. While it does of course rust in time; with reasonable maintenance this can indeed be a very long time. The fact that so much ornamental work survives from three hundred years ago says a lot for the material. On the other hand, steel is well known for its corrodibility, and the intricate forms and water traps of 'wrought ironwork', only encourage corrosion. Hence it is normal practice to coat steelwork with zinc, which does indeed delay corrosion, but neither galvanising nor zinc spraying can effectively be applied to complex forms. Zinc coating of historic work is unacceptable as not only does its application require the destruction of the original surface, which often survives after several centuries, but it is completely irreversible.
2. CONSERVATION PRACTICE; modern conservation practice insists on the replacement of materials with like materials. When wrought iron is available for the repair and replication of wrought ironwork, why use mild steel?
3. TRADITIONAL SKILLS; only by using the traditional methods and materials can restoration work of an appropriate standard be produced. The craft of the ornamental blacksmith, as previously practised to a high degree of skill, was virtually eradicated by the shift to mild steel with its ready application to 'high tech' techniques such as electric welding. Heritage ironwork deserves appropriate repairs by skilled blacksmiths using traditional materials and as such both should be specified in project refurbishments.