

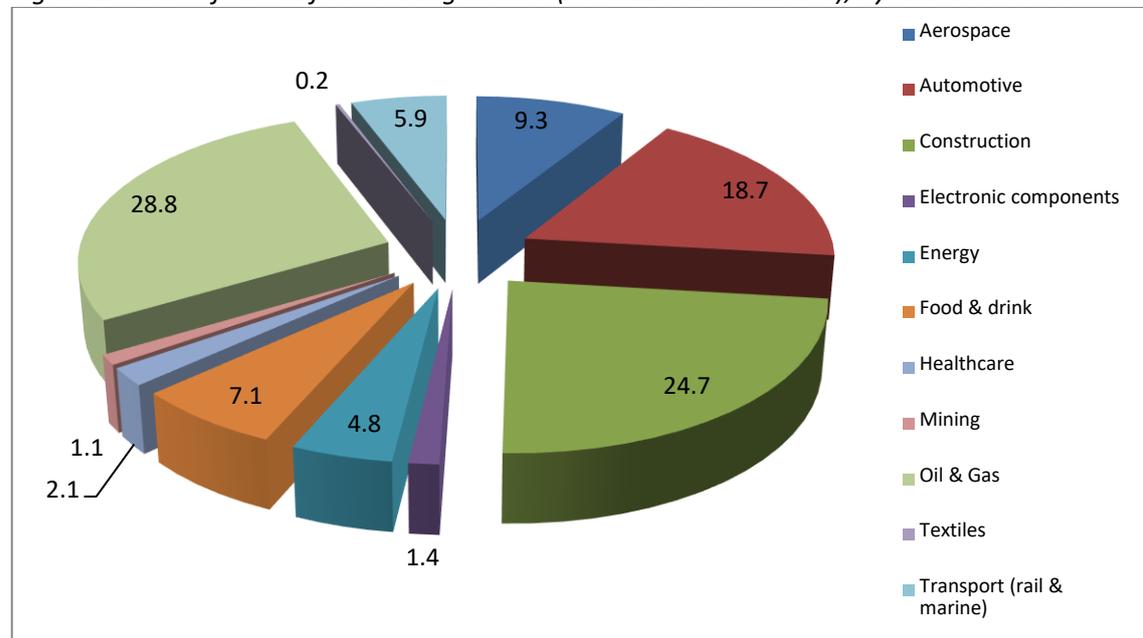
The economic value of surface coatings

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Surface engineering is the formation and application of coatings to the surfaces of other materials that will change their surfaces properties. It is one of the most important sectors in the UK's economy and directly adds value to 50% of the UK's total manufacturing sales of £358bn. In 2015 the UK's market sales for these surface coatings was an estimated £13.5bn and had a value-added factor of 12.8, as they make possible the manufacture and use of products worth £173bn.

There are over 40 generic processes for applying surface coatings and their market embraces virtually all manufacturing sectors, but is the end-user market is dominated by the very diverse sectors of oil and gas, construction and automotive (Figure 1).

Figure 1: Share of the surface coating market (total £13.5bn turnover), by end user sector



Source: Institute of Materials Finishing

The oil and gas industries require coatings capable of withstanding the industry's harsh environments and operating conditions, whilst still providing maximum reliability to functional parts. These coatings include almost every type available and provide high levels of both chemical and abrasion resistance, as well as specialist intumescent and heat resistant properties.

Conversely, the construction industry's demands on surface coatings are more focussed on using wet paints, plastics and powder coatings. Similarly, both the automotive and aerospace industries use high volumes of paints and powder coatings, as well as electroplating, anodising and thermal spraying for component protection and corrosion inhibition.

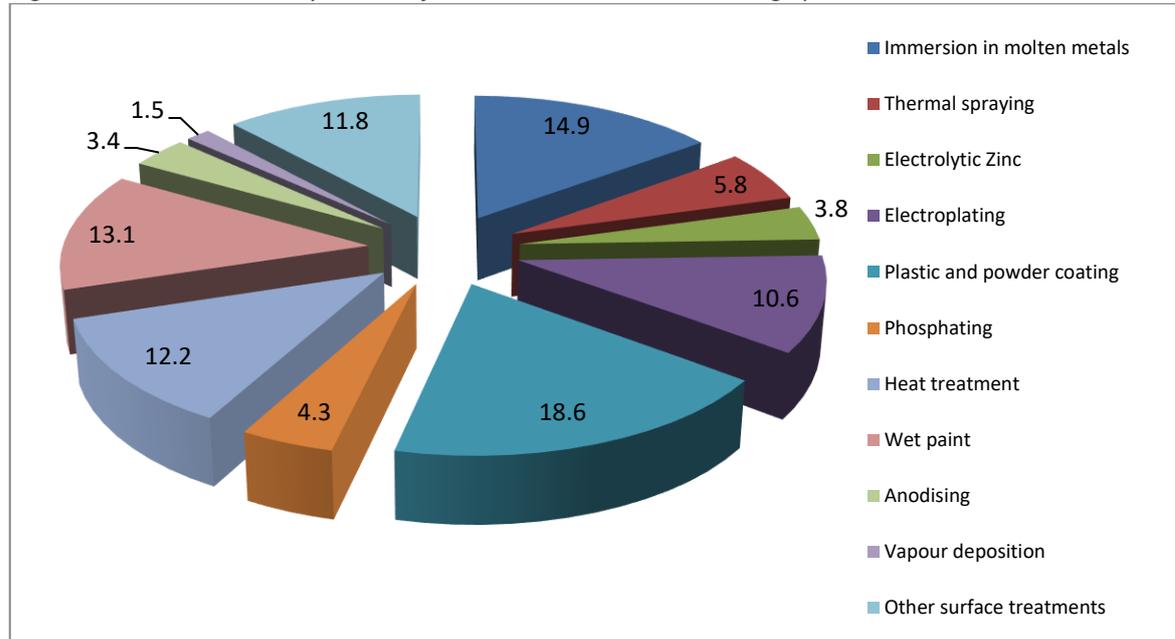
The economic costs of corrosion are difficult to quantify, but it has been estimated that it costs the US economy about 6.2% of GDP [1], with the majority of costs being incurred by the utilities (34.7%) and transport (21.5%) sectors [2]. Whilst no comparable data are available for either the EU or UK, we believe the costs to be very similar. Although potential savings through corrosion prevention are very variable and sector specific, it is estimated that about 20-25% of the incurred costs are preventable by using currently available coatings, saving the UK economy about £27-35bn per annum. It is estimated that about 60% of the aerospace industry's maintenance costs are directly attributed to corrosion [3]. Another area of corrosion related concern is defence; in 2010 the US Department of Defense estimated that corrosion costs represented about 3.5% of its annual budget and, of this, only 9% of the costs were within the military infrastructure and facilities, with the remaining 91% being incurred by the weapons systems and equipment corrosion [4].

The most commonly encountered corrosion is found on metallic products and whilst there are numerous methods of preventing or reducing the impact of corrosion on a metal, the most common is to create a protective layer on its surface. However, not all surface treatments of metals are primarily targeted at corrosion prevention, as although they almost certainly do provide a barrier to corrosion, they may be primarily used for either decorative or engineering purposes. That is, to enhance the surface appearance, such as with a thin coating of gold, or to enhance their operating performances, as with hard or lubricious coatings. In 2015 the coating of metallic surfaces with various materials had a UK market sales value of £1.25bn.

The most common materials used for metal coating is metals, with 35% of the market and a value of £440m; this is followed by plastic and paint, with 32% of the market, valued at a total of £397m. Chemical surface treatments, such as anodising and phosphating hold 8% of the market (£97m), whilst the remaining technologies are worth a further 25% (£319m). However, the largest single coating process is plastic and powder coating, with sales of 18.6% or £232.5m, followed by molten metal immersion (14.9% or £186.8m) and wet paint coatings (13.1% or £164.5m).

Metallic coatings are dominated by liquid metal immersion (i.e. galvanising and hot dipping) with 14.9% of the total market and a value of £186.8m. Coating by the electrodeposition of nickel, copper, chromium and precious metals are 10.6% of the market, valued at £133.1m.

Figure 2: Market share, by value, of metal treatment and coatings processes in 2015



Source: Prodcom / Office of National Statistics

The UK's coating of metals industry is dominated by small companies; in 2014 there were just over 1,300 enterprises employing an estimated 21,600 people [5]. These enterprises have a gross turnover of about £1.6bn and net sales of about £1.3bn [6].

References:

- [1] <http://www.g2mtlabs.com/cost-of-corrosion/>
 [2] <http://www.nace.org/uploadedFiles/Publications/ccsupp.pdf>
 [3] Prevention and control in corrosion; Colavita, M., Italian Air Force found at [http://ftp.rta.nato.int/public//PubFullText/RTO/MP/RTO-MP-079-II//MP-079\(II\)-\(SM\)-10.pdf](http://ftp.rta.nato.int/public//PubFullText/RTO/MP/RTO-MP-079-II//MP-079(II)-(SM)-10.pdf)
 [4] "The annual cost of corrosion for the DOD"; Herzberg, Eric; 2009 found at [https://www.corrdefense.org/Technical Papers/THE ANNUAL COST OF CORROSION FOR DOD.pdf](https://www.corrdefense.org/Technical%20Papers/THE%20ANNUAL%20COST%20OF%20CORROSION%20FOR%20DOD.pdf)
 [5] Eurostat; Annual detailed enterprise statistics for industry (NACE Rev. 2, B-E) updated 14 December 2016
 [6] Office of National Statistics; Prodcom Intermediate estimates 2015; published 15 December 2016

Background to this report:

Dr Trevor Crichton of Oakdene Hollins was asked to write an article for *Science in Parliament*, the in-house science magazine for MPs. The resultant report gave a taster of the industry and its impact on the economy, and is summarised here. It is relevant to much of what Oakdene Hollins is engaged in with regard to metals and materials and to critical raw materials and strategic resources.

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