Environmental Contribution through Surface Modification

What if there were no surface modification?

Corrosion cost in Japan
(Cost of corrosion prevention)

¥4.3 trillion

Metallic wear in Japan
(Chemical loss + mechanical loss)

160 million tons

In recent years, climate change caused by global warming has significantly impacted not only people's lives but the ecosystems of all living creatures. Now more than ever, we need to create a sustainable society.

So, what can we do in the industrial segment? We are considering two concepts to enable sustainable social development: the right material in the right place and longevity.

Humans have been using metals for more than 5,000 years. We will continue to use metals as beneficial materials from the perspective of using the right material in the right place. However, it is also true that a large amount of energy is consumed, and GHGs (greenhouse gases) are emitted while refining metals from ores. Our challenge is how we carefully use the metal materials thus obtained. In other words, it is how we protect metals from corrosion as chemical loss and wear and tear as mechanical loss.

We estimate that the cost of corrosion (i.e., cost of corrosion and corrosion prevention) in Japan is 4.3 trillion yen[*1], which is equivalent to approx. 0.8% of GDP. Assuming that the corrosion cost and metal losses (converted from monetary values) are equal and these losses must be recovered, as much as 80 million tons of CO_2 will be newly emitted in the manufacturing process. On a global scale, this amounts to as much as 3.8 billion tons of emissions, equivalent to 11% of global CO_2 emissions[*2]. On the other hand, friction and wear cost[*3] are also shown in advanced countries. Using this figure to calculate the metal loss in Japan and assuming that this loss must be recovered, as much as 80 million tons of CO_2, equivalent to corrosion, will be emitted in the manufacturing process.

That makes it easy to see how the current corrosion prevention and wear resistance technologies protect metal materials from corrosion and loss and contribute to reducing CO_2 emissions.

*1: Japan Society of Corrosion Engineering and Japan Association of Corrosion Control, Cost of Corrosion in Japan (2020)
*2: Energy Institute, CO_2 emissions (EI statistics)
*3: K. Holmberg: Tribology International, 135, 389-396 (2019)

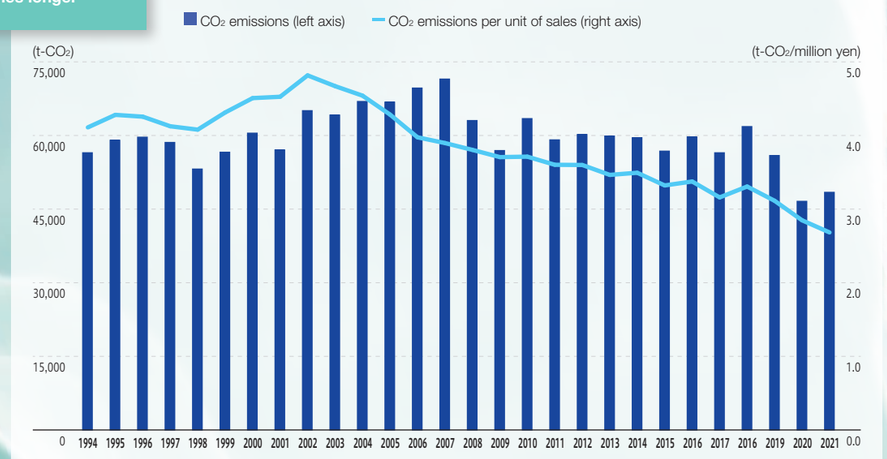
Surface modification change the future

Surface modification technology for hardening surfaces

Wear resistance
12 times higher

Effects of surface treatment coatings (layout) Life of car exterior appearance

3 times longer



CO_2 emissions from the chemicals business

CO_2 emissions

44% reduction

Contribution to CO_2 emissions reduction

As mentioned, we apply surface modification technologies to various metals to protect them. Protecting metals, namely extending their service life, actually curbs CO_2 emissions. So, how effective is it at curbing emissions? We have made the following estimates based on some specific examples.

We supply automobile manufacturers with chemicals that form surface treatment coatings to protect automobile bodies from corrosion. The surface treatment coatings formed by these chemicals can retain the original exterior appearance of automobiles for up to three times longer[*4]. Assuming this reduces the demand to produce new automobile bodies, annual CO_2 emissions would be reduced by 1.77 million tons in Japan, where we directly supply chemicals, and by as much as 5.44 million tons globally.

We also provide surface modification technology for hardening surfaces, primarily for automotive parts. Wear resistance increases 12 times[*5] since this technology forms a modified layer on the metal surface. Assuming a reduced production demand for automotive parts using this technology, as in the previous example, CO_2 emissions could be cut by 470,000 tons per year in Japan and 2.52 million tons per year worldwide, including the Group's own emissions. The above indicates only the automotive parts that we treat.

We have also been striving to conserve resources and reduce hazardous substances contained in our products. In particular, since the 1990s, we have been developing products with a reduction of the environmental impact as a critical factor in R&D. As a result, we have launched phosphorus-free and chrome-free products and technologies.

The figure on the left shows the annual CO_2 emissions[*6] derived from raw materials related to our domestic chemicals business and annual CO_2 emissions converted into values per unit of sales. We have successfully reduced CO_2 emissions per unit each year since it peaked in 2002, with a significant 44% reduction achieved to date.

*4: Calculated based on the results of corrosion acceleration tests (2023) by the Central Research Laboratories, Nihon Parkerizing Co., Ltd.
*5: Calculated based on the results of an abrasion resistance test (2023) by the Central Research Laboratories, Nihon Parkerizing Co., Ltd.
*6: Calculated by using IDEA Ver. 3.2 from AIST