

# Craig Deller

## Conservation of Cultural Heritage

In this conservator's opinion, the additional cost for the fabrication of the artworks by Sunghee Min, Greeting Arc I and Greeting Arc II in stainless steel as opposed to the original proposal of the works to be fabricated in mild steel (low carbon steel) is justified and will not only prolong the lifetime of the sculptures but also reduce the costs of continued maintenance for the following reason:

**Stainless steel is alloyed with chromium, this metal has a much higher corrosion resistance than mild steel.**

The main alloying element is the key factor that distinguishes mild steel from stainless steel. Mild steel is alloyed using carbon whereas stainless steel has chromium as its alloying element. The 2 different alloys produce very different results in corrosion resistance.

Because stainless steel is alloyed with chromium, this metal has a much higher corrosion resistance than mild steel. The chrome in the stainless reacts with the oxygen in the air producing a natural 'chromium oxide' protective skin on the surface of the metal which means that as long as this layer is undamaged, the metal is naturally corrosion resistant. Different stainless steel grades contain different elements to make them more suitable for different environments, such as a marine environment. Mild steel on the other hand does not have this chromium oxide protective layer and so the iron present reacts with the moisture in the air to produce iron oxide or 'rust'. Mild steel, therefore, requires further processing such as galvanizing in order to give it a protective surface. Mild Steel is basically low carbon steel. It contains approximately 0.05% to 0.25% of carbon by weight. Basically, it is not alloy steel and does not contain chromium, molybdenum, or another alloying element. Its chemical composition differentiates its properties from alloy steels.

### **Fabrication**

- As chrome is a hard alloy, stainless steels are much more impact resistant compared to mild steel and (although relatively easy to fabricate) are not as easy to fabricate as mild steel. Mild steel is much more malleable compared to stainless and so is used a lot in general fabrication.

### **Cost**

- The price of the metal is a large factor when choosing stainless steel or mild steel. Although stainless offers far superior life span and corrosion resistance over its mild counterpart, the various alloying elements (particularly chromium) make it more expensive. Coupled with the additional work required to fabricate, stainless steel is the

more expensive however the benefits are an aesthetic metal with superb corrosion resistance and low maintenance.

### **Corrosion-Resistant**

- Chromium is the alloying element in stainless steel and reacts with oxygen in the atmosphere to form a protective layer called chromium oxide. This layer provides considerable corrosion resistance. On the contrary, mild Steel does not have chromium. Iron content in mild steel reacts with moisture in the air and forms iron oxides, which is basically rust. Stainless Steel provides considerable resistance to corrosion, whereas mild steel does not, it requires further coating to prevent rust. Stainless steel is more strengthen than mild steel.
- Chromium can shrug off oxygen without corroding. The addition also pushes stainless steel higher up on the nobility chart.

### **Hardness**

- Stainless Steel exhibits more hardness than mild steel, as Stainless steel contains chromium and nickel.

### **Ductility**

- Ductility is the ability to undergo deformation with cracking. Mild steel has low carbon content, and it is more ductile than stainless steel.

### **Weldability**

- Mild steel is more weldable than stainless steel.

### **Magnetization**

- Mild steel shows permanent magnetization as iron content is more. Conversely, stainless steel does not characterize by the presence of a magnetic field.

### **Aesthetics**

- Stainless steel has more shine and visual appeal than mild steel.

### **Cleaning and Maintenance**

- Stainless steel requires less maintenance than mild steel

### **Life span**

- Existence duration is higher for stainless steel, as mild steel gets corroded much more easily without proper maintenance.

### **Other considerations and recommendations:**

- The assembly of the stainless-steel sculpture onto the proposed base may cause issues if non-stainless bolts are used. When stainless steel and carbon steel are connected, and an electrolyte such as moisture is introduced, stainless steel absorbs carbon steel's electrons. Carbon steel can deteriorate rapidly, become weak, and come crashing down. However, there are some ways to help them work in tandem without causing corrosion: Use a Buffer. They help stabilize structures, which cuts down friction, makes cracks less

frequent, and makes it harder for corrosive electrolytes to slip into metals. Buffers, such as nylon washers or fasteners, can add a protective layer between dissimilar metals in bolts or support beams.

- In email discussions with the artist, Sunghee Min, I have strongly recommended that the application of a sacrificial anti-graffiti coating be applied during fabrication to add to lower the costs of maintenance. There are many commercial anti-graffiti coatings available, however, conservators have studied fifteen coatings, and many performed adequately as graffiti barriers, but three products were deemed best overall because they performed well across the entire range of the assessment criteria. These included a double-component acrylic varnish system and two aqueous, wax-based anti-graffiti coatings. Overall, increasing the number of applied layers did not adversely affect the appearance of the coatings, and additional layers gave some coatings better resistance to graffiti, as well as protecting the paint layer from solvents and other cleaning methods required for graffiti removal. I am partial to waxes due to their ease of removal with solvents that do not put the decorative paint layers at risk.