

An ever-changing masterpiece

If a building becomes architecture, then it is art. (Arne Jacobson)

London's architect Zaha Hadid, famous for her stunning designs, had a clear vision for the Eli and Edythe Broad Art Museum on the East Lansing campus of Michigan State University. She wanted "...a structure that changes as visitors move past and through it – creating great curiosity...". Her desire to echo the surroundings with a skin made of a series of pleats needed a material that could express her vision. Stainless steel's reflectivity and its ability to be molded and bent to any shape proved to be the perfect solution.

Defining the questions

Designing and constructing a world-class art museum poses many challenges, and requires collaboration and cooperation of many parties, each with different priorities. One of the issues was façade material selection. There were several questions the team had to consider with respect to stainless steel as a candidate.

Developing the answers

Alloy and surface finish selection – For a stainless steel façade it was important to select the correct grade to ensure low maintenance and a long life. Because the museum would be exposed to East Lansing's road and walkway de-icing salts, the design team chose the molybdenum-containing Type 316L (UNS S31603) grade. With an Angel Hair® finish, this grade also had the desired appearance: a relative gloss several levels lower than other grades, producing a softer, more consistent and more attractive finish.

Feasibility demonstration – The outside consultants argued that stainless steel would be too expensive, could not be welded, and could not develop the design's sharp pleats. They suggested instead a composite structure for the façade. However, the fabricator, who

Other teams produced alternative façade mockups of aluminum composite panels with a silver paint coating and non-welded joints. There simply was no comparison between these and the stainless steel design. The design team recognized that the Type 316L stainless steel, fabricated as proposed by Zahner, would have much greater impact. The stainless steel could be welded and assembled to create sharp angular planes as if the entire building were machined from a block of gleaming metal, making it a beautiful, iconic sculpture on the campus. One additional significant benefit of the choice of 316L was that at the building's end of useful life, the stainless steel could be fully recycled. In contrast, a composite façade could not be completely recycled.

Panel fabrication – The 316L stainless steel pleats were made from 1.5 mm thick sheets that were custom V-cut to create the pleats. The fabricator used a specially designed mill with an accuracy of 0.005 mm to make these cuts. The formed stainless steel sheets were strong enough that they required no backup support. Each pleat was made of several formed panels, using in total 970 unique panels. The end panels of each pleat were fusion welded using Type 316L wire, argon shielding gas and copper heat sinks to eliminate distortion. These measures kept the weld cleanup and passivation to a minimum.



The Eli and Edythe Broad Art Museum reflects its surroundings and changes with them. © Justin Maconochie

Would it be the right material? Could a stainless steel exterior be built within the available budget? What grade of stainless steel should be used? To help answer these questions the design build team invited Zahner, an architectural fabricator, well versed in the manufacture of stainless steel façades, and other outside consultants to support the project.

has helped to construct some of the most striking stainless steel buildings in the United States, produced several large-scale stainless-steel mockups of the pleats and welds. These educational and strikingly beautiful mockups demonstrated that stainless steel would fulfill the architect's vision and even exceed everyone's expectations.

A breathtaking result

Michigan State University is very pleased. The Eli and Edythe Broad Art Museum is an incredible, iconic building. Thanks to the choice of 316L stainless steel, keeping it stunningly beautiful requires only a fresh water rinse in the spring and autumn. For years to come, passersby will be drawn towards this piece of art. (William Zahner)

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The appearance of the museum transforms as one approaches the building, walks around it, with the weather, the season of the year and with the time of day. It is an ever-changing masterpiece. © Justin Maconochie