

Development of Low-Cost Brazing Filler Metal for Stainless Steel

Member company

POSCO

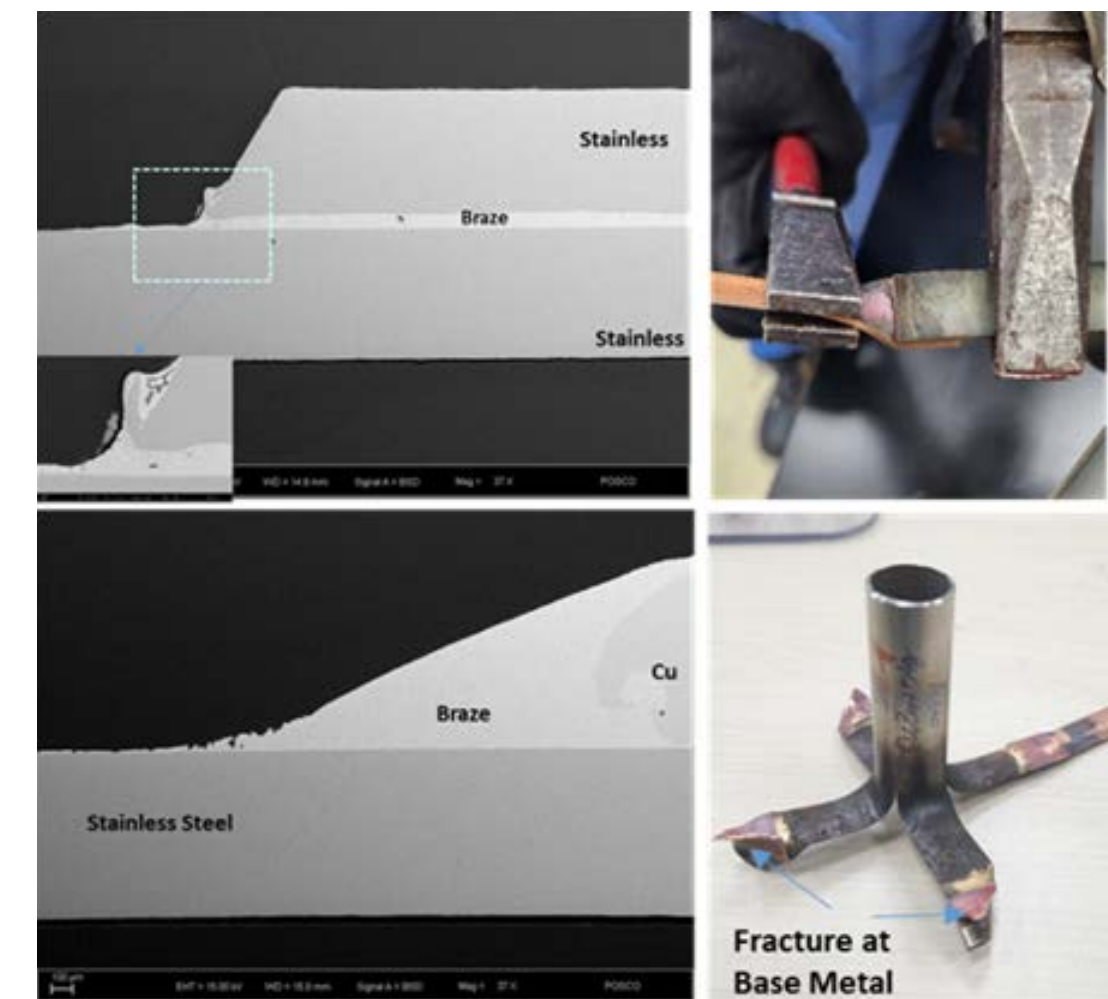
The Challenge

In order to replace the expensive copper tube which is used as an air conditioner's refrigerant pipe, with the stainless steel tube, POSCO had developed a highly-formable stainless steel, 304J1. However, to use it as an air conditioner parts such as refrigerant and heat exchanger pipes, it is necessary to join both of the stainless steel and the copper tubes by brazing method. In the brazing, the brazing filler metal (BAG : Brazing filler metal contained above 30% of Ag) for stainless steel is very expensive compared to that (BCuP : Brazing filler metal contained Cu and P) for copper, thus the brazing cost is remarkably increased. To commercially widespread use the brazing both of stainless steel and copper,

POSCO has developed a new low-cost and good quality brazing filler metal, which is 5~6 times cheaper than that of BAG. It will effectively cut down the manufacturing cost of customers who want to use stainless steel by replacing copper tube, and join the both of tubes by brazing process.

Why?

The customer who wants to replace copper with stainless steel tube asked for the development of low-cost brazing filler metal. It is not easy to widely use the stainless steel for an air conditioner's refrigerant pipe without the cost-down of brazing filler metal.



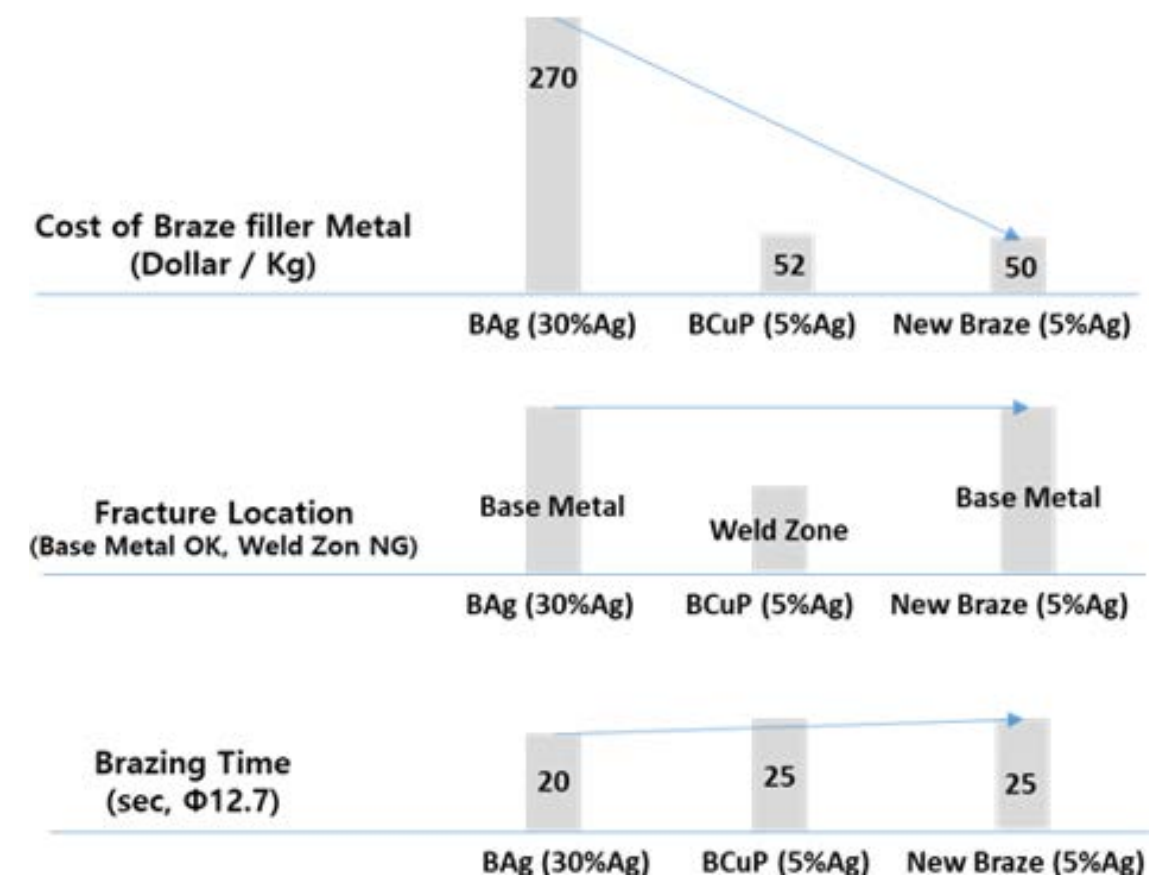
Microstructure and mechanical test

Needed action

POSCO has developed the cost-effective brazing filler metal by designing the usage of competitive alloys. A newly designed brazing filler metal was mainly based on the Brass (Cu, Zn) alloy system, and added a small amount of Ag, Al, Ni, and Mn.

To lower the melting point and improve the wettability, a small amount of Ag was added since Ag is very expensive element, about 910 \$/kg, thus the amount of Ag should be restricted within 3~5%. Moreover, less than 1% of Al was added to supplement the wettability, and also less than 1% of Ni and Mn were added to improve the workability, bonding strength, and corrosion resistance.

P is known as an effective element which can reduce the melting point, thus it normally added to 5% or more. However, in the case of stainless steel brazing filler metal, P content should be extremely limited because it easily reacted with Fe in stainless steel, which resulted in the formation of brittle intermetallic compound (Fe_2P , Fe_3P). The formed intermetallic compound deteriorated the interface strength of brazed joint both of



Quality position

stainless steel and copper, and then easily caused to fracture under the shear stress condition.

Action review

Specific: Tube of air conditioner’s refrigerant and heat exchanger, and ‘frame’ of stainless steel bicycle

Measurable: Fracture location, Brazing time (sec), Product price (\$/kg) and



Torch Brazing Process

Wettability

Achievable: Satisfying the brazing properties between stainless steel and copper tubes, and promoting the sales quantity of POSCO’s highly formable Stainless Steel

Realistic: Electronic, Boiler and Bicycle companies in Korea and China have been testing the newly developed brazing filler metal, and will be using it in their

manufacturing process.

Time-bound:

From 2022, newly developed brazing filler metal has been produced at the co-worked company DAECHANG, and successfully met with the

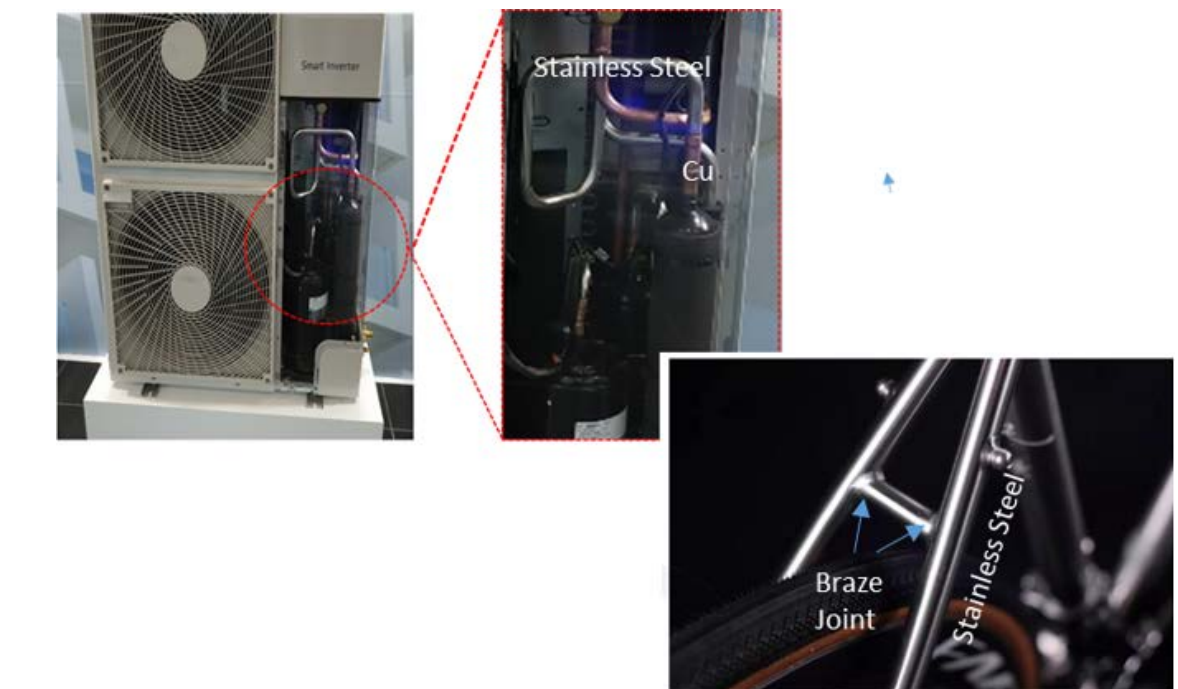
requirements of customer’s.

Horizontal Expansion Capability

First of all, it can be applied to all industries that want to replace copper tube with stainless steel. The newly developed brazing filler metal can be used to reduce the brazing cost of a company that uses stainless steel tube at the air conditioner fields.

Outcome

In the case of using a brazing filler metal containing more than 30% of Ag, the price of filler metal is about 270 \$/kg, but in the newly developed filler metal, the price was lowered to about 50 \$/kg level. Therefore, customers who want to use the stainless steel instead of copper tube, can achieve a manufacturing cost reduction by approximately more than 5 times. Also, for POSCO it is possible to increase the sales amount of stainless steel, 304J1.



Applications of air conditioner and bicycle