ICSMA19 Metz, France, June 26 - July 1, 2022
International Conference on Strength of Materials

Characterization of interfacial mechanical properties of carbon steel-stainless steel corrosion resistant clad plate

Jung Yun Won[a], Chanmi Moon[a], Sung-Woong Kim[b], Myoung-Gyu Lee[a]

[a]*Department of Materials Science and Engineering & RIAM, Seoul National University, 1 Gwanak-ro, Gwanak-gu, Seoul 08826, Korea*

[b]*SeAH Steel Corp., Goedong-ro, Nam-gu, Pohang, Gyeongsangbuk-do 37863, Korea*

[a]*e-mail: myounglee@snu.ac.kr*

The mechanical performance of clad steels is affected by the robustness of interfacial bonding of heterogeneous bimetal with distinctive microstructural and mechanical properties. In this study, the mechanical behavior of a hot roll-bonded carbon steel-stainless steel (CS/SS) clad plate is evaluated using uniaxial tensile and interfacial de-bonding experiments, while the interfacial characteristics are examined through various microstructure analyses with different length scales. The debonding properties are inversely characterized based on hybrid experiment-numerical procedure by implementing a mixed-mode bilinear cohesive zone model (CZM) in the finite element (FE) simulation. The CZM is used to identify the traction-separation behavior of the clad interface with the assumption of linear elastic fracture mechanics (LEFM), which is confirmed from the microstructural analyses. The proposed FE modeling is validated through V-bending test, where the CS/SS clad interface presents obvious cohesive damage effect on its delamination during large deformation. Finally, the underlying fracture mechanism and interfacial bonding characteristics of the investigated clad plate are suggested through the post-analysis of fractured surface.

Keywords: Clad plate, cohesive zone model, finite element method, delamination, damage

Acknowledgement: This work has been supported by KEIT (No. 20010717),), which is greatly appreciated.