We would like to thank the reviewer for reviewing our manuscript and giving valuable comments and suggestions. We also highly appreciate your supervision of the reviewing process. According to the reviewer’s instructions, we have made careful modification on the original manuscript, and the revisions have been highlighted in the manuscript. Below you will find our point-by-point responses to the reviewer’s comments.

Reviewer #1:

Even though the paper contains scientific novelty, its readability (typos, text arrangement) should be improved and then, the article should be re-reviewed. Simply, in current form, the paper is difficult to go through. The paper could be shortened and rewritten to be more concise.

Responds to the comments:

**Point 1: In material and methods, the geometry of the tool should be presented.**

**Response 1:** Photographs of the instruments used in the experiment have been added to the manuscript (Line 107, 136, 138, 149).

**Point 2:** Authors write "The samples were polished using silicon carbide paper up to 1200 grit (Line 93) before corrosion fatigue test." - The geometry of the samples should be explained. Which surfaces were polished? The whole four plates of dog bone sample? Please explain.

**Response 2:** The geometry of the samples were selected according to the requirements of corrosion fatigue testing machine. The upper and lower surfaces of the sample were polished. It has been added in the manuscript (Line 90-93).

**Point 3:** In the fig. 2 the roughness in the right sketch should be given.

**Response 3:** Figure 2 in the original manuscript (Figure 3 of the revised manuscript) presents the corrosion fatigue specimen details. The upper and lower surfaces of the samples (Figure 3) were polished, the two side surfaces were not polished. In Figure 3, graphic □ represents the upper and lower surface of the sample need to be polished, and the number 1.6 in the figure represents the roughness. Graphic □ indicates that the side surfaces are kept the original incision state without any polishing. The drawing and symbol rules refer to *drawing standards of ISO 1302-2002 (E)*.

**Point 4:** I am worried about the geometry of the samples used for fatigue tests. Samples were machined to obtain a 2 mm thickness. Therefore almost 8 mm of the sample was removed. It is not clear if the sample was taken from the middle of the 10 mm plate? Especially while the weld
was wide for 25 mm (see Figure 1). Please provide details of the dog bone location in the as-welded sample.

**Response 4:** The geometry of the samples are selected according to the requirements of corrosion fatigue testing machine. Because the upper surface of weld was uneven after friction stir welding, a thickness of 3 mm was polished from the upper surface. In addition, to avoid the influence of the incomplete welding of the lower surface on the specimen, a thickness of 5 mm was also polished from the lower surface. Therefore, the thickness of the sample was 2 mm. And Figure 2 has been added to the revised manuscript to show the sampling location.

![Figure 1. A diagram showing the location of the samples](image)

**Point 5:** The samples numbering is not clear. Please add the table to explain the sample codes. (Section 2.2).

**Response 5:** The samples numbering in section 2.2 are used to distinguish samples of different stress amplitude. The explanation is given in lines 96 to 99 of the revised manuscript. The samples numbering’s corresponding stress amplitudes are shown in Table 4 (Line 157).

**Point 6:** This phrase is not clear "Because the fracture (Line 108) position of the corrosion fatigue fracture will change after polishing." - Please explain it.

**Response 6:** According to the requirement of the microstructure observation, the sample should be polished. But if polishing the corrosion fatigue fracture directly, both the fracture morphology features and the position of the corrosion fatigue fracture will be changed. So the microstructure of the fracture were observed through the upper and lower surfaces perpendicular to the fracture of the specimen.

**Point 7:** There are too many phrases "Error! Reference source not found…" therefore it is really difficult to go through the manuscript. It must be improved.

**Response 7:** All "Error! Reference source not found" have been revised in the manuscript in the red font.

**Point 8:** All the literature references are placed in the text as a "free numbers" it must be
improved and placed in square brackets.

Response 8: All the literature references are placed in the text have been placed in square brackets in the revised manuscript.

Point 9: Macrostructure given in Figure 4 should present whole joint cross-section. Therefore, more photos are needed.

Response 9: The base metal zone has been added to the joint cross-section (in Figure 9, Line185). With this, the overall joint cross-section are presented in Figure 9.

Point 10: Figure 7 is not clear. The reader does not understand the meaning of the arrows, description and "round element on the left". Please improve it.

Response 10: The arrows point to the position of the cut specimen, and white rectangles on the disk are specimens for microscopic observation, black rectangles on the specimens are areas of microscopic observation. The figure has been improved. (Figure 12 in revised version) and it has been described Line 194-198 of the manuscript.

Point 11: Figure 8 - I think that the microstructure is much more affected by the location of the sample, and the area of the FSW joint from which the sample was machined.

Response 11: As the reviewer mentioned, the microstructure is much more affected by the location of the sample, and the area of the FSW joint from which the sample was machined. But in this manuscript, corrosion fatigue specimens were sampled from FSW welded plates. The corrosion fatigue specimens have been includes the entire area of FSW welded joints. The welded joints of the corrosion fatigue specimens shall be similar in microstructure to the FSW joints of the welded plates in the same area. So the location of corrosion fatigue fracture (in the WNZ? TMAZ? HAZ? Or other region?) was determined by comparing the microstructure as shown in Figure13 (Figure 8 in the original manuscript) of the corrosion fatigue sample’s fracture with that of the welded plate joint.

Point 12: Explain in the paper the meaning of the phrase "the upper (Line183) and lower surface" at its first usage in the text.

Response 12: The upper and lower surfaces are the two surfaces perpendicular to the thickness of the specimen, their positions are indicated in Figure 2 (Line103).

Point 13: Authors write that "river-like morphologies around the pits (Line 272)" - but it is not visible in the SEM photos. Please provide the SEM with higher magnification and mark it in the fracture-photo.

Response 13: The river pattern is the typical morphological feature around the corrosion fatigue source[^R1, R2]. The river-like morphology is enlarged in the manuscript in Figure 16 and the location of the river-like morphology is marked (Line 295).

[^R1]: Wen Wang, Ruiqi Xu, Yaxin Hao, etc. Corrosion fatigue behavior of friction stir processed


Point 14: The difference between the secondary and primary cracks is not clear and I am not convinced with that - please explain it. Please provide the explanation for distinguishing the types of cracks.

Response 14: There are multiple crack sources in corrosion fatigue, and the crack sources usually occur in corrosion pits. Due to the difference in microstructure and structure of FSW welding joint at different positions, the corrosion pits first appeared in the area with the worst corrosion resistance. In the manuscript, the main crack source is at the boundary area between WNZ and TMAZ where the earliest corrosion usually occurs. The corrosion pits in this area gradually grow up and lead to the crack appearance. With the extension of corrosion time, other areas of the welded joint also produced corrosion pits as the source of fatigue. With the extension of loading and corrosion time, the corrosion pits gradually deepened and crack was formed. With the further aggravation of the corrosion degree, TMAZ on the upper surface and side of the specimen also began to appear multiple corrosion pits and develop into small cracks, many small cracks grow at the same time, gradually intersect to form one or more large cracks, and the fracture are usually along the direction of large crack growth. The crack source corresponding to the crack that eventually leading to the fracture of the sample is called the main crack source and the others are named the secondary crack sources. The fracture morphology (Figure 16) shows that the corrosion is more serious at the main crack sources and lighter at the secondary crack source. So in order to distinguish different crack sources, the authors proposed to distinguish the main crack source from the secondary crack source. (It has been revised in Line 264-267).

Point 15: The conclusions are difficult to evaluate because the paper content is blurred.

Response 15: The whole manuscript has been improved carefully in both content and language. The English writing of the revised manuscript was carefully edited by a native English speaker and highlighted in red in the revised manuscript.

Thanks very much to you for your patient review and good comments.

We have tried our best to improve the revised manuscript, and all the comments are quite helpful for improving the quality of our work. We hope the new manuscript will meet your magazine’s standard.

Sincerely,

All the authors