Response to Reviewer 2 Comments

Dear reviewer:

Thank you very much for your suggestions; they have helped me improve the quality of my paper. I have corrected the errors in my paper and followed your suggestions. These changes are shown in red font in the revised paper. In this letter, I have responded to your questions. Please let me know if I need to make additional changes to my paper.

Point 1: First of all, indicate somewhere in the paper what the post-processing treatments the specimens underwent after the SLM production.

Response 1: The projectile after SLM production is only subjected to simple surface smoothing and heat treatment, and the heat treatment process is described in the blue letter section on page 4 of the article. The following picture is the bullet diagram after SLM production.

The actual printing laser power of the SLM process is 195 W, the scanning speed is 900 mm / s, the scanning spacing is 0.11 mm, the single-layer printing thickness is 0.02 mm, and the substrate material is 304 stainless steel. The heat treatment process of SLM specimens is stress relief annealing, specifically holding at 482 °C for 4 hours and furnace cooling.



Point 2: What is the built direction of the specimens, especially those for the notch and quasi-static tensile tests?

Response 2: The red arrows below indicate the direction of the SLM build.



Direction of sample construction

Point 3: Did the authors analyse if different built directions could influence the mechanical properties?

Response 3: This article has not yet analyzed the impact of different construction directions on material properties, and will continue to be carried out in the follow-up work.

Point 4: What is the original dimension of the specimens before they are machined up to the right dimensions for the tests?

Response 4: The diameter of the SLM specimen before processing is slightly larger than the diameter after processing, machining allowance is about 1mm thick. The size of the projectile after forming is almost the same as the finished product, and the surface is only simply smoothed.

Point 5: Please, enlarge the pictures in Figures 2, 3, 11, 16, and 18.

Response 5: These five images have been enlarged to the appropriate size.

Point 6: How many specimens have been tested for retrieving each curve?

Response 6: Each curve in Figure 4 was tested only once, and each curve in Figure 7, Figure 13, Figure 17, and Figure 19 was tested three times.

Point 7: Have the authors measured the specimens before and after the tests?

Response 7: Before and after the test, the diameter, length and other dimensions of each specimen are measured, and the data processing of each shot is analyzed according to their actual dimensions.

Point 8: There are some missing lines in Fig. 9. See in orange the missing lines of one of the three sketches.

Response 8: The missing lines have been added. In order to make the picture clearer and more complete, Figure 9 is rearranged.

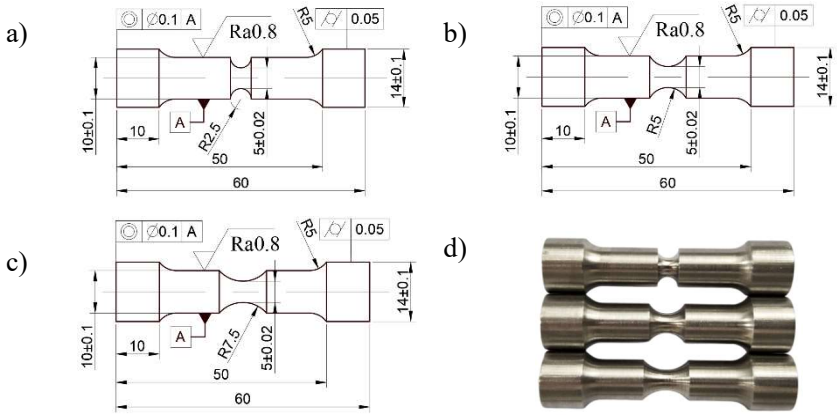


Figure 9. Dimensions and outline of the notch tensile test piece.

Point 9: the authors are asked to provide an explanation of why the SLM properties are so higher than the forged ones.

Response 9: The advantage of SLM rapid cooling makes the grains of the formed 15-5PH steel finer, and the strength and plasticity are improved simultaneously. The rotation of the laser scanning path vector between the layers of the SLM process will hinder the growth of columnar grains. The elongated grains are broken, the grains are more refined, and the fine grain strengthening effect is prominent. In this paper, the scanning strategy of SLM rotates 67 ° between layers, which hinders the continuous growth of columnar grains, makes the stress and temperature distribution more uniform, the printing structure more dense and more uniform, and makes the mechanical properties of the material excellent. Forging process in the forging process will destroy the original metal coarse grains, grain crushing, refinement, improve the mechanical properties of steel, but the degree of grain refinement than the degree of grain refinement SLM process there is a big gap.

The results of quasi-static tensile test show that the tensile strength and elongation of SLM processed 15-5PH steel are higher than those of forged 15-5PH steel. The fracture analysis shows that SLM processed 15-5PH steel is ductile fracture and forged 15-5PH steel is brittle fracture. SLM process improves the toughness of

15-5PH steel. The results of notch tensile test show that the failure strain of the specimen increases with the decrease of stress triaxiality, and the SLM process improves the failure strain of 15-5PH steel. High temperature test results show that the compressive strength of SLM processed 15-5PH steel is higher than that of forged 15-5PH steel at 400 °C. It can be known from the penetration concrete test that the penetration ability and abrasion resistance of the SLM process to the projectile are slightly improved, and there is no obvious improvement in mechanical properties.

Thank you again for taking the value time to review my paper.