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The evaluation of rate sensitivity in fracture toughness of SUS304 by small punch test

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Austenitic stainless steel SUS304 is a type of TRIP steel in wide meaning and shows the excellent fracture toughness. On the other hand, the fracture toughness can be evaluated in a variety of deformation rate by the small punch (SP) test using a tiny disk specimen. In the past, it is reported that the rate sensitivity in fracture toughness of SUS304 indicates negative from the result of SP test [1]. The detailed fracture process in SP test for the ductile materials has not been clarified. Thus, a finite element simulation of SP test by introducing damage processes is performed [2]. The results show the fracture mechanism is different between low and high deflection rate. The fracture in a thin specimen is considered to be caused by the mixed fracture mode and the fracture mode might affect rate sensitivity in fracture toughness. In this study, the quasi-static, dynamic and impact SP tests for SUS304 are conducted for evaluating the rate sensitivity in fracture toughness. In addition, the fracture surface of specimens after the tests are observed by the analysis of fractography by a scanning electron microscope. It is proved that the fracture mode changes with the deformation rate.

Keywords: Fracture toughness, Small punch test, Austenitic stainless steel SUS304, Rate sensitivity, TRIP

References:

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