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Crack initiation of the S-phase on the pre-deformed austenitic stainless steelSang-gweon Kim¹, Seong-chul Kim², Masahiro Okumiya³, Jae-Hoon Lee⁴

¹Korea Institute of Industrial Technology, Incheon, South Korea ²Mirae thermotec, Daegu, South Korea ³TOYOTA TECHNOLOGICAL INSTITUTE, Nagoya, Japan ⁴ KITECH, Incheon, South Korea

kimsg@kitech.re.kr

The plasma nitriding technology leads to the formation of high concentration of nitrogen on the austenitic stainless steel (ASS) surface, called S-phase or expanded phase for austenite stainless steel. The S-phase is well known for its excellent properties such as improved hardness and wear resistance with sustaining corrosion resistance. However, the fracture of the S-phase on the ASS was often observed after plasma nitriding processing, which seriously deteriorates the anti-corrosive properties of the S-phase. The formation of cracks in the S-phase depends on different processing parameters during nitriding, which is closely related with the residual stress due to the diffusion of nitrogen atoms into the ASS. In addition to that, the residual stress can be developed during work hardening of the ASS, which is also one of the reasons for the destruction of the S-phase. In the study, Crack formation of S-phase on the pre-deformed austenitic stainless steel was investigated. The S-phases on pre-deformed ASS were prepared using screen plasma nitriding process. Microstructure, hardness and glow discharge emission spectra of the prepared samples were investigated. Based on the experimental results, diffusion mechanism of nitrogen and carbon in the ASS during nitriding was discussed. Also, the relation between pre-deformation of the ASS and the mechanism of crack formation after nitriding was discussed.

Keywords

Screen plasma nitriding
crack
austenitic stainless steel
S-phase
severe deformation