higher the strength of the steel, the greater the susceptibility of hydrogen embrittlement. Thus considering from strength and structure, the order of hydrogen embrittlement possibilities was X80>X70, slow tensile test results well proved this point.

The research of the behavior of hydrogen and the loss of mechanical properties for pipeline steels in simulated coal gas environment

The susceptibilities of hydrogen embrittlement of simulated coal gas environment were investigated by SSRT. The results are shown in Fig. 11. For the same steel, the strength loss in simulated coal gas environment, the strength loss of X80 steel is the more significant than X70.

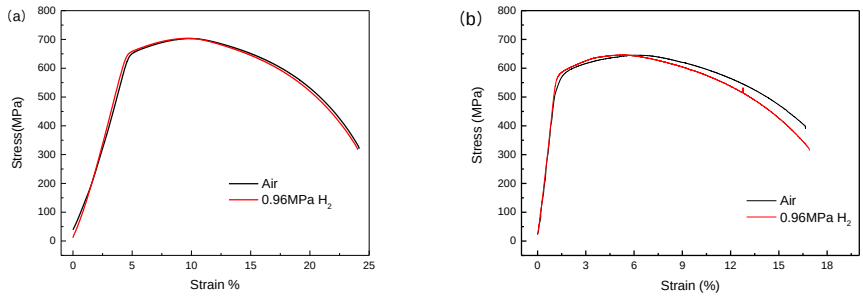

Figure 11: Tension curves of different pipeline steels under simulated coal gas environment(a)X70 (b) X80

The ductility loss and hydrogen embrittlement susceptibility of the steels were expressed by the reduction of area (Ψ) and hydrogen embrittlement sensitive coefficient (F_H) respectively, which were extracted by Eq. 4 and 5. To compare the hydrogen embrittlement susceptibility of different steels under coal gas environment, the Ψ and F_H after SSRT is shown in Figures 12and 13.

Fig. 12 showed that the reduction of area of X70 steel was the less than X80, which indicates the slight loss of ductility of X70 steel, the ductility loss of X80 steels were more obvious.

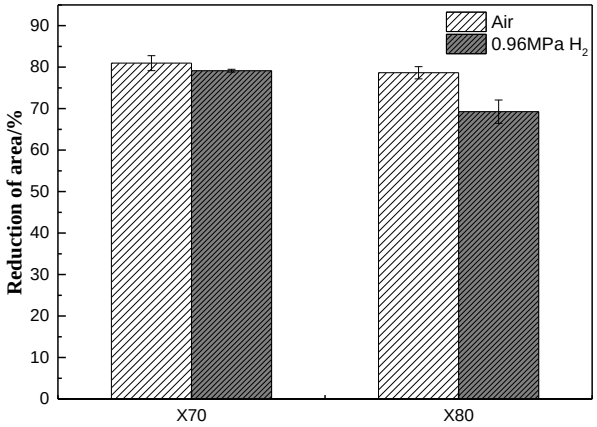

Figure 12: Reduction of area of the different pipeline steels under simulated coal

gas environment

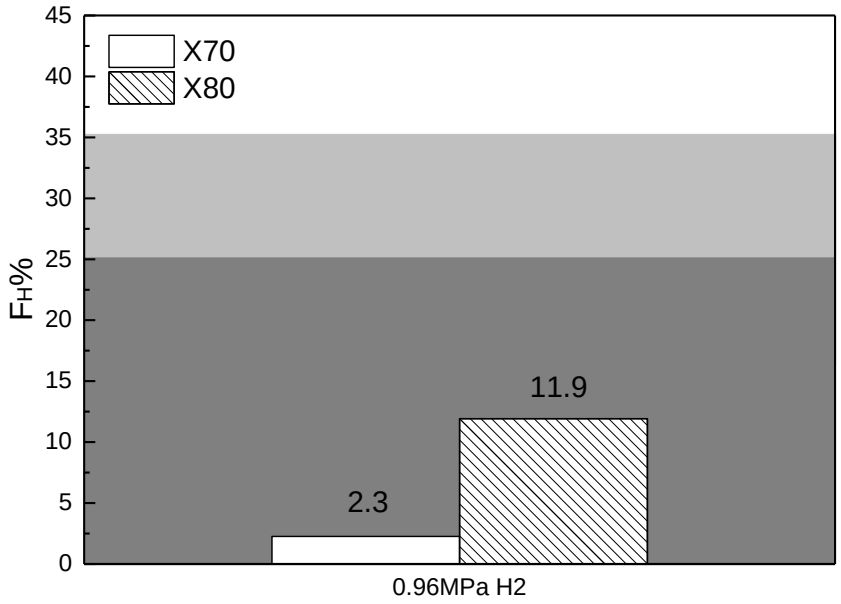

Figure 13: F_H of the two kinds of pipeline steels under simulated coal gas environment

CONCLUSIONS

(1) The uptake and diffusion of hydrogen in the pipeline steels increased in accordance with the sequence of X70, X80 steel, and higher grade of steel indicated higher hydrogen diffusivity.
(2) There existed the maximum value of the hydrogen content in all steels under -1.2 Vvs.SCE for different time. And the maximum value was larger in the higher grade of steel, which represent higher accumulation ability.
(3) For the same grade of steel under cathodic protection, the more negative the applied cathodic potential, the lower the tensile strength, revealing the ductility losses increase with the negative shift of potential.
(4) The ductility loss of X80 steel is the more obvious than X70, and with the negative shift of potential and the increase of steel grade.
(5) The ductility loss of X80 steel is the more obvious than X70 under simulated coal gas environment.

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