Simulation of Flow-accelerated Corrosion based on Wall Shear Stress on Metal Surface

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Flow-accelerated corrosion (FAC) causes wall thinning of carbon steel then damages structural soundness of pipelines and planets. In order to prevent serious accident and control structural soundness of them, understanding the mechanism and prediction of FAC is important. This study presents a FAC simulation with fluid dynamics, electrostatic analyses and electrochemical measurement. The simulation deals with the effect of fluid properties of metal surface on corrosion speed. First, polarization curves, which give corrosion speed under a potential, are modeled as a function of the wall shear stress. Second, the wall shear stress on metal surface is determined through fluid dynamics analysis with immersed boundary method to consider complex geometry of surface. Finally, electrostatic analysis is carried out to obtain corrosion speed on metal surface with the modeled polarization curves. The simulation is developing based on a free open source CFD package OpenFOAM.

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