
The relationship between microstructure of CO₂ corrosion product film and corrosion behaviour using SRCL

Hu Wang, Zerui Yang, Chengyao, Wen, Juan Xie
Southwest Petroleum University, Chengdu 610500, China

Abstract :

CO₂ corrosion is commonly existed in oil and gas field production, which is influenced by various factors. The film of corrosion and scaling products coated on metal surface has a significant impact on the corrosion behavior. Although numerous studies have been carried out on the CO₂ corrosion product film under various conditions, establishing a correlation between the microstructure of the corrosion product film and its corrosive behavior remains challenging due to limitations in research methodologies.

High-temperature and high-pressure corrosion weight loss experiments were carried out, along with in-situ electrochemical testing techniques under elevated temperature and pressure conditions, to investigate the CO₂ corrosion behavior of N80 steel in varying calcium ion environments. With a comprehensive analysis of the corrosion product film, valuable insights can be obtained regarding the growth mechanism of CO₂ corrosion films under various conditions. Among them, the high-resolution three-dimensional tomographic scanning imaging of product films is achieved by using synchrotron radiation computed laminography (SRCL) technology to obtain the 3D morphology and porosity distribution of product films. Based on this, a correlation model between the microstructure of CO₂ corrosion product films and the corrosion behavior is constructed. This research work holds significant theoretical value in enhancing the understanding of CO₂ corrosion mechanism and under-deposit corrosion behavior, thereby establishing a crucial theoretical foundation for effectively managing CO₂ corrosion under intricate operational conditions.