Offshore & Dredging Engineering

Technische Universiteit Delft

Corrosion in Underwater Offshore Slip Joints

In order to connect a monopile to a transition piece of an offshore wind turbine efficiently, a new connection method called the Slip Joint is being developed. The Slip Joint is made out of a conical section at the top of the monopile foundation and a conical section at the bottom of the transition piece which are slid over each other to form a connection. Van Oord is currently getting the Slip Joint connection certified by DNVGL, requiring that the structural integrity must suffice during the total lifetime. Offshore with harsh salty conditions, corrosion important to be aware of. The interface between the cones of the Slip Joint creates a local environment with crevices that has a unknown corrosion behavior. Because it is necessary to know the corrosion behavior within the Slip Joint, the following research question has been formulated: What corrosion behavior can be expected in offshore submerged Slip Joint crevices?

Because research towards steel crevices of large geometries was not carried out before, a test method had to be developed. This required multiple innovative methods, and thus trial tests to confirm the feasibility of the test method. Chosen is to use specimens with multiple crevice geometries and test them during a 60 days immersion test. In total 260 steel plates and 37 different crevice geometries have been studied on their corrosion behavior. To monitor the corrosion behavior during the test period, open current potentials have been measured. After the test period the specimens were cleaned and weight losses have been measured. With the weight loss measurement, the corrosion rate of each specimen has been calculated. Additionally to testing the corrosion behavior in crevices, the usability of Impressed Cathodic Corrosion Protection on a crevice is tested by applying a current on the specimens using a potentiostat.

The data of the tests show that the test was carried out in a consistent manner and that the test method gives reproducible results. The test indicate that local corrosion attack in the crevices of the Slip Joint can occur and that the corrosion behavior is correlated with the crevice geometry. A model has been formulated which can be used to estimate corrosion rates in crevices for design purposes.

Student
Koen de Bruin
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Sponsor
Van Oord

Thesis committee
Prof.dr. M. Veljkovic
Ir. J.S. Hoving
Dr. Y. Gonzalez Garcia
S. Suur, MSEng