North of England Evening Meeting:
High performance coatings for corrosion protection in subsea underwater and offshore environments.

Department of Marine Technology, Armstrong Building, Newcastle University

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The first evening meeting of 2020 gave the North of England SUT branch an insight into marine coatings. Bas Hesselink who is Segment Manager for Oil & Gas and PFP at AkzoNobel; started with an overview of the company. AkzoNobel is a global paint and coatings company which includes the 'International' brand, along with household names such as 'Dulux'.

Bas gave us a bird's eye view of the site in Felling in the North East, where paint is produced and where their state of the art global R&D facility is located after a recent €12.6 million investment. It has dedicated test labs, for cyclic and non-cyclic testing, temperatures up to 350 degC, pressures up to 300 bar and a cryogenic lab for LNG applications.

The International paint brand is split into three divisions Marine, Protective and Yacht with a comparison described as "a protective coating looks good 5 meters away and a yacht coating looks good 30 cm away." Protective coatings, Bas' specialism, are used in various industries from upstream and downstream Oil and Gas applications, nuclear and coal power plants and high volume infrastructure. Two local projects are the Sage and Millennium bridge on the Newcastle/Gateshead quayside.

Bas explained the "McDonald's model", whereby paint purchased in one part of the world should be the same specification and quality as that purchased in another location. This is particularly important for projects where parts are made in different locations and need to come together to perform. An Australian project was used as an example where sections were manufactured and coated in Russia, China, Thailand and Singapore and then transported to Australia to be installed and function in the same environment.

Bas explained the importance of understanding the lifecycle of the asset because "coatings do not have a brain!" Bas explained the manufacture of FPSOs, FLNGs and fixed platforms, historically fabricated in Singapore and Korea are moving to China for production. Therefore, the environment where the coating is applied and cured has a different temperature and humidity. The transport method and conditions to the end location is important, if it is on the back of a ship, corrosion from saltwater will need to be considered. The end location, where the asset will spend most of its life is important such as strong UV resistance in Australia or whether cathodic protection will be used, the

temperature and harsh environments etc. The application and use of coatings also need to be registered in the parts of the world they will be used.

The challenges of developing coatings were discussed, typically customers are looking for performance to last >25 years to be economically viable. Inspection of assets is expensive due to inaccessibility and therefore a low inspection rate is specified. Remedial repair is very expensive so confidence in the coating's performance is paramount. The industry is moving to deeper waters so there are new challenges that come with this. Along with contradictions in the specifications such as protection during thermal loading but requiring flexibility from the coating during transportation and as lightweight as possible to keep the total asset weight down. In conjunction with cost reduction in all areas which are squeezing the coatings budget.

The use of differing coating techniques for a single application was explained using the example of an offshore wind turbine;

1. Foundations are below the water, within in the splash zone and have very limited accessibility once installed so a Hybrid Epoxy technology would typically be used.
2. The tower typically has 3 coatings of a different coating.
3. The turbine blades use yacht coating technology because they are generally made from GRP and protection against rain erosion is important. If erosion occurs this can cause imbalance on the blades.
4. The nacelle coating needs to be fire retardant and oil resistant.

Since 15,000 BC coatings such as blood, egg & animal fat have been used to preserve buildings and assets. Bas explained in the 1970s liquid epoxy lead to a reduction in viscosity and an increase in the solid content and reduced the need for solvents. The development of coatings in recent times has been H&S driven both in terms of harmful ingredients and the safety of personnel on an asset to ensure they can safely evacuate from the asset in the event of a fire or cryogenic spill.

Question topics received from the audience were on nano technology, which is work in progress, and self-healing, which is difficult to get a robust solution for such harsh environments. Discussions continued after the talk, over refreshments. The branch would like to thank Bas for providing such an interesting talk, Newcastle University for the use of the lecture rooms and the Branch Sponsors for their continued support.