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Erosion-Corrosion: Modelling informed by slurry jets and pots

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The phenomenon of erosion-corrosion has been studied extensively by various investigators but no accurate model has been developed to predict the interactions between erosion and corrosion. This is mainly attributed to the complexity of the interactions that generate either a synergistic or antagonistic effect for a particular material in a certain environment. This paper will review present erosion-corrosion models and their applicability. A semi-empirical model, recently developed at Southampton based on contact mechanics and effected area corrosion approaches will be used as an example of modelling approaches being deployed at present. It will be shown that robust predictive models are still some way away. However, the model has been found to have good agreement with erosion-corrosion rates for carbon steel in a slurry pot. This paper will also evaluate the robustness of this semi-empirical model by testing it on the passive UNS S31603 stainless steel. Results will also be compared with a fully empirical model derived from the erosion-corrosion literature. The erosion-corrosion mechanisms are identified and are used to challenge the simplistic assumption and physical approaches used in current models. Slurry jet erosion-corrosion of cast NAB will also be investigated and material removal mechanisms identified. The inability of models to incorporate microstructural aspects of the target surface, nascent surface mechanical and electrochemical properties, real effected or depassivated areas, repassivation kinetics and composition, microgalvanic effects and the lack of using relevant mechanical properties will be explored along with the effect of corrosion on mechanical properties of surfaces. Out of this review some new approaches will be suggested and constraints of using present models will be highlighted.