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Artificial Neural Network for Yield Strength Prediction of Irradiated RAFM Steels

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Structural materials to be used in proposed fusion reactor will be exposed to hostile neutronic environmental conditions. These steels will interact with high energy neutron particles. The interaction is expected to degrade structural material properties such as loss of ductility, increase of yield strength and DBTT temperature. Artificial neural network (ANN) with back-propagation (BPN) technique is used in this work to develop a numerical model which predicts the change in yield strength of irradiated steels at various irradiation condition. More than 15,000 material related parameters such as composition, temperature, yield strengths are obtained from literature. These experimental results are used to generate more than 100 networks after proper training, testing and validation. A statistically validated neural network is used to predict the change in yield strength of RAFM steel in the range of 290 K – 900 K and 0 – 80 DPA. For instance, at 673 K and 300 K of test temperature and irradiation temperature, the yield is first found to increase and then remain constant after 50 DPA. Again at the same test temperature and higher irradiation temperature of 700 K, the yield strength is first found to increase till 25 –30 DPA and then decreases thereafter. In the work we plan to present such kind of behavior at different temperatures and DPA conditions.

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