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Modeling of the Microstructural Evolution in Cr-Mo Steels During Tempering and Hydrogen Exposure

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Hydrogen attack is a dangerous material degradation process that occurs in steels subjected to high pressures of hydrogen at elevated temperatures. A detailed study of the coupled processes responsible for hydrogen attack requires a combination of continuum mechanics with solid solution thermodynamics, kinetics and chemistry. This paper is concerned with the development of numerical models that combine these ingredients. First, a relatively simple microstructural model is presented which takes into account these processes within the framework of a multi-component, multi-phase continuum description. The numerical model is developed for microstructures built up by a ferritic matrix and carbides such as M_7C_3, $M_{23}C_6$, M_6C and M_2C. This model is applied to predict the microstructural evolution in low alloy Cr-Mo steels during tempering and hydrogen exposure. Secondly, the first steps in the development of a finite element code for a second more sophisticated model will be addressed.

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