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A research on the microstructure, mechanical properties and corrosion kinetics in Zr-Nb-Fe alloys

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It has been reported that corrosion kinetics transition phenomenon in Zr-Nb-Fe alloys is triggered by lateral cracks in the oxide film. To further investigate the mechanism of this phenomenon, four Zr-Nb-Fe alloys with distinct chemical compositions were prepared via conventional rolling/annealing process and second β-quenching/low temperature final annealing process. Scanning electron microscope, transmission electron microscope, nano-indentation and autoclave corrosion tests were jointly carried out to characterize in detail the microstructural features and mechanical properties of alloys and oxide film formed in the corrosion. The results indicate that it takes more time for the occurrence of corrosion kinetics transition phenomenon with the increase of the alloy strength. However, if the alloys with different composition have almost the same strength, the corrosion kinetics transition phenomenon takes place earlier when the oxide film has lower hardness. The reasons for the above results can be attributed to the fact that lateral cracks are presented in the oxide film above the sharp crests of undulations of oxide film and metal interface before transition, which results from the deformation of matrix. The alloy with higher strength can resist the deformation of matrix and thus retard the evolution of undulated interface. Then, the lateral cracks in oxide film appear later. However, the oxide film with lower hardness is easier to be cracked since it may exist more flaws, such as pores and micro-cracks.

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Degradation of boscalid by nitrogen-doped/undoped TiO_2 and persulfate ions using different activation conditions and the identification of its main degradation products using LC/MS/MS

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Degradation of boscalid (Bd) in aqueous solution was studied using different oxidation systems, including persulfate ion (PS), TiO_2 (UT), N-TiO_2(NT) and mixtures of UT/PS and NT/PS under sunlight irradiation, in addition to using heat-activated (50 or 80°C) PS ions. NT had a higher percentage for Bd degradation than UT, which was explained by a higher surface area and a higher amount of anatase for NT. However, systems of NT/PS or UT/PS did not degrade Bd as much as PS alone under sunlight, which may have resulted from the interaction between the produced hydroxyl and sulfate radicals. Eventually, the highest Bd degradation was obtained by the activation of PS at 80°C. On the other hand, degradation of Bd in aqueous solution containing MeOH by NT or UT was completely inhibited. MeOH is a scavenger for both hydroxyl radicals $OH^{\bullet}$ and the positive hole of the activated catalysts. In addition, the PS system was more affected by MeOH presence than were the UT/PS and NT/PS systems. This result can be explained by the fact that i) MeOH scavenged further $OH^{\bullet}$ than $SO4^{\bullet}$- and ii) more $SO4^{\bullet}$- was present for systems of UT/PS, especially for NT/PS, than PS. Therefore, NT/PS or UT/PS systems have a higher percentage of Bd degradation in aqueous solution containing MeOH than the PS system. Eventually, an analysis of Bd residues and the identification of its 7 basic intermediates were carried out using LC/MS/MS.

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