

## The Effect of Cold Deformation on the Microstructure and Corrosion Resistance of Duplex Stainless Steel

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**Abstract** Duplex stainless steel is widely used in corrosive environments such as petrochemical and marine engineering due to its excellent mechanical properties and corrosion resistance. It consists of both ferrite and austenite phases, and its performance largely depends on the ratio and distribution of these two phases. Cold rolling is a common method for processing duplex stainless steels, and different cold rolling deformation levels can significantly affect its microstructure and corrosion resistance. This study systematically investigates the effects of different cold rolling deformation amounts (such as 10%, 30%, 50%, and 70%) on the microstructure of 2205 duplex stainless steel, explores the evolution mechanisms of the austenite and ferrite phases during the cold deformation process, and analyzes their impact on the material's corrosion resistance. The research results indicate that the microstructure of duplex stainless steel undergoes significant changes with the increase of cold rolling deformation. Cold deformation causes the strengthening of both the austenite and ferrite phases, with a gradual reduction in the volume fraction of the austenite phase, and a phenomenon of deformation-induced martensitic transformation occurs. The ferrite phase experiences refinement and changes in orientation, while the increase in dislocation density during deformation leads to a significant enhancement in the material's hardness and strength. The undeformed 2205 duplex stainless steel exhibits excellent resistance to pitting and crevice corrosion, with a stable passive film in chloride media. However, as the amount of cold rolling deformation increases, the integrity of the passive film on the material's surface gradually deteriorates, especially in high strain areas where the passive film is more prone to damage, resulting in a decrease in corrosion resistance. With the increase of cold deformation, the accumulation of residual stress and the significant deterioration of the uneven deformation of the phases near the grain boundaries increase the local stress corrosion tendency, which has a negative impact on the corrosion resistance.