

Increasing Microbiological Corrosion Resistance of Hydropower Turbine Blade Steel

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The 13-4 martensitic stainless steel is used for hydro power turbines. Its nickel content, along with low carbon ensures better weldability, ductility, impact resistance and fatigue resistance properties when compared to 13 Cr ferritic-martensitic grades. It has good corrosion resistance in fresh water and performs well under erosion-corrosion phenomena. It is specially designed for all applications requiring high mechanical properties combined with high toughness and may be used in medium corrosive conditions. The applications and production process (casting) mean that the steel has to have good weldability.

Due to changed conditions in Slovenian rivers (warmer water, stagnant stream) microbiologically induced corrosion (MIC) has occurred on turbine blades. MIC is a particularly unpredictable phenomenon that is primarily caused by bacteria. Low waterflow conditions enable the attachment of microorganisms to metal surfaces, the colonization enables the formation of a film (biofilm), followed by the attachment of diverse microorganisms, among them some have the ability to reduce/oxidise ions in water, which leads to corrosion. The phenomenon is closely connected to pitting and crevice corrosion. Pitting corrosion resistance can be swiftly evaluated by Pitting Resistance Equivalent Number (PREN). This particular study is aimed at increasing the PREN while maintaining the mechanical properties of the modified steel. Steel samples with modified chemical composition and increased PREN were made and tested for mechanical properties.