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Fracture Toughness of Large Forgings for Power Producing Industry

Václav Mentl
University of West Bohemia, Pilsen, Czech republic

Abstract:

The steam turbine rotors represent large components both in radial and axial directions. Their local properties generally differ from one forging to another, or if we compare head and bottom parts of the original ingot, or central and circumferential localities of one rotor body respectively, or if we compare the properties of separate discs e.g. in the case of welded rotors. These differences stem from both even slight changes in the chemical composition (of separate heats or even within one ingot) and thermo-mechanical treatment and in the differences in technology with respect to the real shape and size of the forgings in question.

In the paper, the consequences of the differences in fracture toughness characteristics in various rotor localities are discussed with respect to the rotors operational safety taking into account the existence of cracks and material degradation.

Keywords: Fracture Mechanics, Steam Turbine Rotor Steels, Large Forgings

Introduction

At the beginning of the 70´s last century, a department of Fracture Mechanics was established within the Central Research Institute of the Skoda Works in Pilsen (Czech Republic) to solve the problems of fracture toughness and the resistance to brittle fracture of large steam turbine rotors. At that time, 50 MW steam turbine rotors in service (produced after the world war II) were approaching the end of their designed lifetime, the new generation of 200 – 500 MW steam turbine rotors were already in service and the goal was to prepare rotors for up to 1000 MW power plants, see Fig.1.

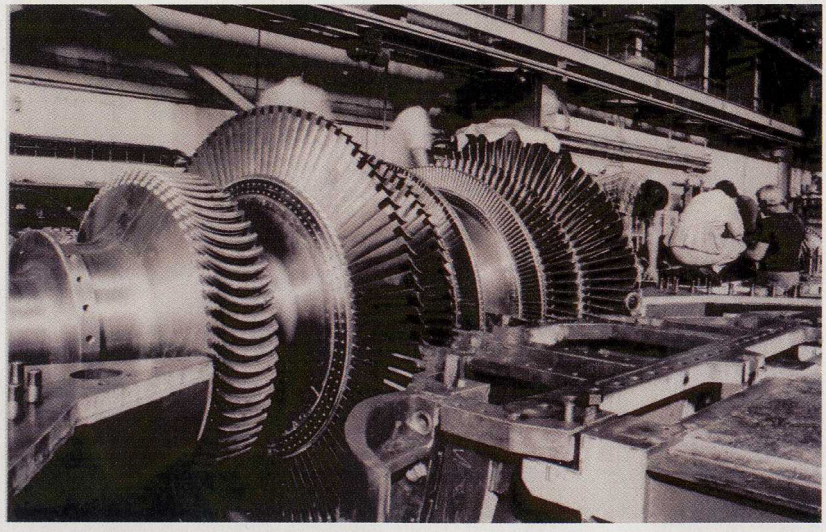

Figure 1 An example of welded low-pressure rotor